

PANDORA'S BOX
The Story of Conservation



By Marian E. Baer

THE WONDERS OF WATER

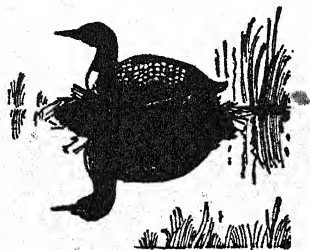
PANDORA'S BOX: THE STORY OF CONSERVATION

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By
MARIAN E. BAER

ILLUSTRATED BY
ALLEN POPE, JR.



FARRAR & RINEHART
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TO MY MOTHER

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AUTHOR'S NOTE

The story of Pandora is one of the oldest stories in history. Every boy and girl has heard it at some time during his school days. The beautiful Pandora, endowed by each god with a special gift, was sent down to the world where man lived. Jupiter gave her to Epimetheus, who welcomed the girl and spoke kindly to her: "The house and garden are yours, Pandora. You may pick the flowers, walk in the woods, talk to the birds and animals, eat the fruit from the trees. Nothing will harm you. But there is one thing in our home which you must not open. That is the golden box you will find there."

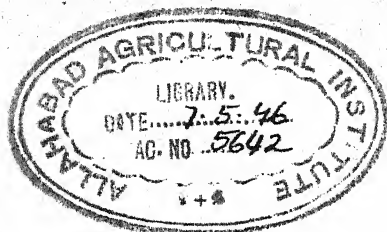
You remember what happened. The unfortunate girl could not resist the forbidden box. She raised the lid and out flitted many small creatures. They were troubles set free in an innocent world. Pandora had never seen such strange things. As she watched them fly away into all parts of the garden and off into the woods, she did not know of the evil they were bringing.

America, too, was a garden when the first set-

tlers came here. The newcomers, like Pandora, were eager to explore everything. They pushed their way from the east to the west. There was no corner they did not venture into. To them the vast American continent seemed endless. They did not think that its wealth could be exhausted through their recklessness.

But the day came when there was no more virgin land to explore. At the beginning of the last depression Americans were rudely awakened to what has been going on in their country—the havoc that has been wrought in field, forest, and stream.

Pandora found one small creature, Hope, still in her box after the trouble bearers had fled. For Americans, today, amidst the difficulties they have brought on themselves, there is a redeeming note. It is something more substantial than hope alone. Leaders among us, our new pioneers, are dissatisfied with the wasteful ways of yesterday. Using the same initiative and curiosity the old pioneers showed, they are calling on us to help them examine every part of our country carefully. The new pioneers are scientists and the new frontier is conservation of our own natural resources—our rich topsoil and many rivers; the great areas of trees on our watersheds; our wildlife in forests, fields, streams, and along our sea coasts.



CONTENTS

CHAPTER		PAGE
	AUTHOR'S NOTE	vii
I	A LOOK AT THE PAST <i>Frontiers Advancing</i>	3
II	A LOOK AT OUR COUNTRY TODAY <i>Mountains Move Down to the Sea</i> <i>—Red Fog Over Boston—Dust</i> <i>Bowl Farmer—Michigan Lumber-</i> <i>man in Trouble—Rugged and</i> <i>Ragged, the Southern Mountain-</i> <i>eer</i>	7
III	OLD REMEDIES FAIL <i>Hard Times! Yesterday and Today</i> <i>—Businessmen Complain, Econ-</i> <i>omists Are Called In</i>	24
IV	THE WHITE MAN IN THE LAND OF THE INDIANS <i>The Land of the Indians—The</i> <i>White Man Arrives—The Forest,</i> <i>Enemy of the Farmer—The For-</i> <i>est, Friend of the Fur Hunters—</i>	

CHAPTER		PAGE
	<i>Hunters Push Their Way West— The Father of Waters</i>	31
V	RUINED ACRES, MURKY RIVERS <i>Bare Hills and Sawdust Towns— Lost! a Swamp—River Fish in Trouble—The Sportsman Com- plains</i>	44
VI	RIVER TROUBLES <i>Rising Waters—The Mississippi, Every Man's Business—Ole Man River—Gambling with Nature— Floods from Upstairs—Ailing Rivers</i>	57
VII	WATERSHED TROUBLES <i>Red-Letter Problem: the Water- shed — Something Went Wrong with the Watershed — Farmers Turn Scientists—Hidden Rivers, Hidden Lakes</i>	73
VIII	THE GROUND UNDER OUR FEET <i>Of More Value than Gold—Migs —No Soil, No Life—Soil: Many Kinds—Soil Washing Out from Under Us—Ten Thousand Years to Make One Foot of Topsoil— Canadian Rocks Travel South to New England—Rich Land, Bottom- less Soil</i>	83

IX

SENTINELS GUARD US

What Holds the World Together?
—Guardians of Our Watersheds—
"Cut Out and Get Out": Then
What?—City Building and Clean
Water Do Not Go Together—Laws
Protect, But Even Laws Must Be
Protected—The Demon Fire—
FIRE! Rqaring Inferno! 106

X

ONE THING DEPENDS ON ANOTHER

Life on the Earth Changes Slowly
—Something about Ancient Ani-
mals, Pedigreed and Otherwise—
Animals and Plants Depend on
Each Other—A Well-balanced Ex-
change—Geese That Were Geese!
—Man Has Been Stepping In and
Speeding Up Change—A Closer
Look at the Upset Balance 126

XI

PESTS AND EPIDEMICS

Epidemics—An Unwelcome In-
vader from Africa—Too Many
Muskrats—Millions of Rabbits—
Cacti March In and March Out—
Starving Animals—Sacks of Locusts
—Midwesterners Make War on
Grasshoppers—Birds to the Rescue 141

XII	THE POTHUNTER—FRIEND OF NO MAN <i>Sportsmen vs. Pothunters—Pothunters and Civilization along the Flyways</i>	156
XIII	A SEARCH FOR CONTROLS <i>Meantime?</i>	163
XIV	LOST! ANOTHER SWAMP <i>Destruction in the Everglades—Ruined Acres Abandoned by Man and Animal</i>	165
XV	UNCIVILIZED CIVILIZATION <i>Industry: Enemy of Wildlife—Oil: Enemy of Birds—Oil on Water: The Fisherman Complains—Other Longshore Troubles—Wildlife vs. Pothunters</i>	176
XVI	THE BEAVER, *A NATURAL CONSERVATIONIST <i>The Beaver Grows Popular—Animal Engineers During the Hurricane of 1938—Fair Exchange—Beavers Work for Uncle Sam—Odd Neighbors</i>	190

XVII MODERN PIONEERS

Grey Owl, America's Friend—Epidemic: of Hunters and Plowmen—A New Kind of Army: Conservationists—Pioneers in the Conservation of Wildlife: The Audubon Society—Boy Scouts of America—4-H Clubs—Town Forests—The "Plant to Prosper" Club—R. T. R. . . . 198

XVIII CONSERVATION GOES AHEAD

Towns and Colleges Are Becoming Alert—The Cut-out-and-Get-out Idea Should Be Scrapped—Landowners Complain about the Tax System—Drinking Water and Dumping Place 223

XIX UNCLE SAM'S LABORATORIES

Many Knock at Uncle Sam's Door—The Conservation Program Comes of Age—Gardens in Alaska—Seven-fifty per Acre, No More, No Less—Huge Undertakings—Ruined Acres Return to Uncle Sam—Smoky Hill—Another Mistake Set Right by Uncle Sam—Grandpa Fenton Moves to a New Home—Uncle Sam's Forests—Uncle Sam Helps Private Business 233

XX CONCLUSION 275

	PAGE
ACKNOWLEDGMENTS	283
BIBLIOGRAPHY	285
INDEX	289

PANDORA'S BOX
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I. A Look at the Past

FRONTIERS ADVANCING

1600! A few hundred white people are living in the eastern part of our country. A steady flow of tiny sailing vessels from Europe brings in handfuls of venturesome people to a forest-covered country. Nearly a dozen good-sized log cabin towns are scattered along the Atlantic coast.

1700! A few thousand white people are living along the eastern seaboard. Forests are quickly giving way to great clearings. Tobacco and corn fields are making the South rich. Small factories lie close to waterfalls in the North. Here cloth is woven and ships, guns, kettles, and spades are turned out. England is complaining that America is taking away her trade, while English ladies at court wear coats of finest American ermine. European kings, unable to find money to pay debts to their favorites, are giving them magnificent stretches of American land instead. Colonial farmers along the coast are beginning to turn their eyes away from England, and are looking hopefully toward the west.

1800! About 2,000,000 people are living along the eastern seaboard, a few hundred more in tiny towns along the western coast, and some in thriving towns strung along the broad Mississippi. Our country has decided that it will not be ruled by a king living either in Europe or on this side of the Atlantic. Its first great President, George Washington, died a year before and Thomas Jefferson, a great democrat and a farmer, has been chosen by the people. In war-ridden Europe, Napoleon is hot on the heels of scurrying Germans, French, Dutch, and others. Soon he will need money for his expensive campaigns. In 1803, to help pay his debts, he sells to the United States an "empire" for a few million dollars. That empire is the Louisiana Territory. It is as big as the whole eastern United States of that day! It is the cradle of the great Mississippi River, yet it cost only \$15,000,000. That seemed a staggering price at the time, though today a plot of ground in New York City may cost as much.

1900! About 95,000,000 people are living in our country! Buffaloes, that used to stampede in herds of thousands across the great western plains, have disappeared—steam monsters pulling long trains of steel cars and belching black smoke, have

driven them from their grasslands; farmers have poured in, bringing mowing machines and harvesters instead of spade and hoe. Indians, most of their lands taken from them, are living on reservations. Showboats on the Mississippi, the great "wild West" tradition, free lands, gold booms—all have come and gone! The continent has been "conquered"!

Hundreds of cities are today humming with life in our country. In New York City alone there are about four times as many people as lived in the whole United States in 1800! Factories that turn out everything from a pin to an automobile are found north, south, east, west. Millions of men and women stream from these factories and from places of business when the hands of the clock point to five. They go by bus, subway, train, or car to their homes "uptown" or out of town.

Graceful bridges span our great rivers; streamlined trains carry passengers, merchandise, mail, from coast to coast in four days, airplanes in less than one day. Fine roads link every part of the country together. Oil stations, chain stores, cafeterias, motion-picture houses, tourist camps, and hotels at all the crossroad towns make life for

autoists and trailerites as comfortable in one part of the country as in another.

Doors of schools, libraries, colleges are open free to any who wish to use them, from toddlers to veterans. Money, efficiency, and speed have been the bywords of our fast-growing country. It has been quick work! Too quick for people to stop to see what was happening.

II. A Look at Our Country Today

MOUNTAINS MOVE DOWN TO THE SEA

If you should pick up the newspaper some morning and read, "Mt. Lassen, in California, a little more active. Sends out stream of boiling lava over green countryside," you would not be greatly astonished.

"Well," you might remark, "it takes a volcano to move the inside of the earth and pile it up on the outside."

But if one day you picked up the newspaper and read, "Rocky Mountain uplands pulling up stakes; moving downstream!" or "Alleghenies, day by day, cutting loose. Rushing at top speed down the Tennessee and Ohio rivers!" you would be amazed.

"Why," you would say, "nothing can be more solid and firm than the Alleghenies! It would take earthquakes to move those great highlands from their age-old foundations. But they are dead. No signs of volcanoes or earthquakes of any great account can be found in them. There may be a few earthquakes among the Coast Hills of Cali-

fornia now and then, but in the Rocky Mountain plateau and the Allegheny Mountains, rarely!"

Nevertheless (though it does not get into the papers in just these headlines), large parts of the Rocky Mountain uplands actually are leaving the West and moving south, downstream; or east, blown by the wind. This is happening not only today or yesterday, but every day of the year. Parts of our country are leaving us by water and parts by air. During our recent hot, dry summers, headlines in the papers might have read, "Western uplands going east by way of the air as well as south by water!"

Not long ago an article appeared in the paper about a man who had climbed the Matterhorn, a very high peak in the Alps. To prove to his friends that he had actually been to the top he hacked off a huge slab of rock and with the help of friends carried this down into the valley. "Here," said he to the surprised people of the village at the foot of the mountain, "is the top of the Matterhorn! I am going to take it home as a souvenir!"

Now, though chunks of mountains seldom move downhill in this fashion, our mountains, hills, and uplands are daily moving into the val-

leys pebble by pebble, grain by grain, particle by particle. Today some of our rivers, with an increasing load of mud, reach the sea three times as fast as they used to. In hilly farm country heavy rains wash off all the topsoil after two or three corn crops. In some parts of the Arkansas hills a foot of topsoil has been washed off in the last thirty years, and it takes nature hundreds of years to build one inch of topsoil! One-half of the good farmland of Tennessee is gone, washed down by water. This ruin was accomplished within the past century!

The tearing away, grain by grain, has been speeding up during the last fifty years as more land is cut over or plowed under. Today, every twenty-four hours, 400,000,000 tons of mud, topsoil from hills and farms, are washed into brooks, streams, and rivers. Few of the people who work in our large eastern cities and ride to and from their offices in subways or fast suburban trains realize what is going on quietly in many parts of our country. Few reporters scouting around for front-page stories pay any attention to these sensational happenings taking place under their very noses. Bushel by bushel, ton by ton, our moun-

tains, hills, and plains are disappearing downstream.

Water in hilly country tears out much topsoil, but during dry weather wind is just as bad, perhaps worse. Experts do not always agree about this. On a dry windy prairie a patch of soil not held down by grass may grow and spread year by year like a disease, creating a desert of moving sand dunes.

During a searing hot summer in parts of the Middle West high winds have been known to pick up millions of tons of dust in a single day! Sweeping across the vast fields, dust clouds are carried a mile into the air only to fall little by little over other parts of the country.

When topsoil has been blown away, only the coarser soil lying below is left. This is unfit for crops. If even the coarser soil is blown away, what remains? Hardpan, the stony ground below the coarse soil. This is worthless to farmers.

A few years ago the man in the street began to realize that somehow the farmer's affairs in the West had a great deal to do with the stock market in Wall Street. Newspapers had been in the habit of hushing up disaster stories, since land speculators and railroad companies said it would injure

their business to publish them. "No one will go west to buy land," they said, "unless we do some boosting. If soil is good, we'll say so. But we won't say anything about the shortage of rainfall. If rainfall and climate are good, we'll print that, but we won't add anything about the eroded topsoil!"

In the early 1930's newspapers and magazines started to print many stories of problems that had become national—droughts, floods, forest fires, pests, farm mortgages. Business was bad. People wanted to know what was the matter, for another depression, which seemed to have its center in Wall Street and the banks of our country, was upon us.

Here are four stories of the kind that began to appear in newspapers and magazines a few years ago.

RED FOG OVER BOSTON

One day in the early summer of 1934, the good people of Boston noticed that the air seemed foggy. Yet there was no moisture in the air. The sun was red. Housewives dusted their mahogany furniture in the morning only to find it coated with dust, red dust, in the afternoon! Here was something new! They called up the university

near by. They were told that this was western farmland dust.

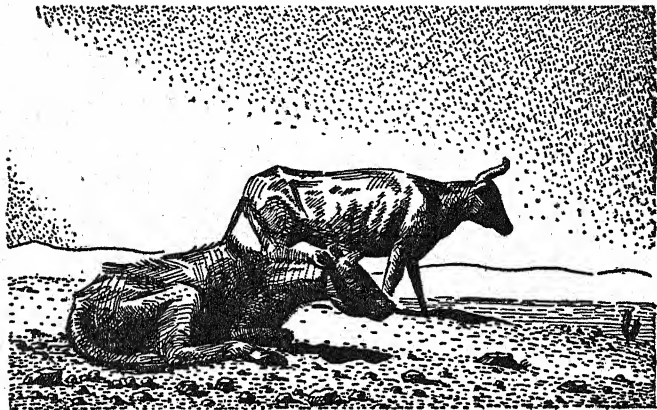
A professor's wife looking at it thought, "Perhaps this very dust once lay in the fields of a Kansas or Nebraska farm! Perhaps it nourished wheat crops or barley. Now it has come east and lies on my staid Colonial furniture here in old Boston! And more of the red dust is on its way out to sea. Something must be very wrong in the West."

DUST BOWL FARMER

During the summer of 1934 a South Dakota wheat farmer sent a story like this to a newspaper. He had gone in for wheat farming during the World War:

"My farm here in South Dakota is about done for. I myself am done for unless I can get some help. Hot, dry winds have been blowing all summer. The air is full of black dust. My wheat came up in the spring when we had a little rain, but it got no farther, since no more rain fell. Day after day we watched the skies. Not a cloud! We have used up all our feed corn and hay for our cattle. There is no place for my animals to graze, and the springs in their pastures have gone dry.

"Last year it was bad enough; but this year things are worse! I've lost twenty good cows already! Yesterday I sold the rest for what I paid for one Jersey cow six years ago. I've sold my horses for a quarter of what I paid for them.



Drought.

"There is no work I can do in these dried-out acres. There'll be no crops to take to market. I've sold my farm trucks and have only a small Ford car left. Even that is ruined. The black dust and sand have done more than take the shine off it, they have got into the engine! It doesn't do much good to clean the thing—grit would blow in the next time I tried to drive to town. There's no use

in staying here, and there's hardly any use in driving to town—the dust is blinding everywhere. Besides, no one there can help me. We're all in the same boat.

“I sent my wife and two children away three weeks ago. My wife and I had stuffed all the cracks of our windows with rags to keep out the dust! It was no use, the dust got in just the same. My children had throat trouble. They got it from breathing this terrible dust—and eating it too! You may think that we farmers ought to have plenty of fresh air out in the great open West, but it's the one thing we don't have in my part of the country—at least not these last few summers!

“My poplar trees around the house are all but dead. They used to help keep the place cool; now even tree roots can't find water. Their leaves have dried and fallen and blown away. The water table has dropped more than ten feet in two years. My well is almost dry—but not quite. That's why I'm still here. However, I'm going tomorrow.

“I'm going to drive to town for the last time to find out about the Matanuska colony. They say there's a fertile green valley up in that part of Alaska. The government is lending money to a number of Dust Bowl families who don't mind a

long trip so long as they can start over again. I am planning to go. The government will probably take over my farm here. They are welcome to it. No one will buy the place. I couldn't pay anyone to take it off my hands, I guess.

"You say business is not good in parts of the East. Well, it is worse in the Dust Bowl. These lands should never have been sold for farms. When I came here my acres were fields of grass—no timber anywhere on them or near them. That should have warned me. No timber means no rain, or only enough to keep buffalo grass going in these parts. That grass makes such a deep carpet that a few dry seasons would not hurt it. Not even a gale could move such a tough, heavy mat of roots.

"But plowing up the land and turning the grass roots under—a tough job it was, too—put an end to the buffalo grass, and started the farm moving. I see bushels of my topsoil whirled into the air and blown east every day, rich land that I bought so that my children would have a good home when they grew up! And the dust from my neighbor's farm sweeps in over my acres. The wind has been having its own way. My sheds and chicken houses

are half covered up right now—snowed under, you might say, with black dust!”

MICHIGAN LUMBERMAN IN TROUBLE

A newspaper reporter met a friend who had just come from southern Michigan. He had



Farms were snowed under with black dust.

traveled east as a representative of lumbering interests in his state. “I haven’t seen you for ten years,” said the reporter as he shook hands with his friend, Mr. Strand. “How is business?”

“Bad, very bad!” said Mr. Strand. “Never saw business go down like this. I came east to go to a convention in Washington—lumbermen’s con-

vention. Some of my friends are in trouble just as I am. We are going to ask the government for advice."

"What makes business so bad in your part of Michigan?" asked the reporter. "That's not a part of the Dust Bowl. Michigan is a beautiful state and you have enough rain to keep things growing, haven't you?"

"Yes, plenty, of rain—too much, just now. It's washing out the whole countryside!"

"How do you mean?" asked the reporter. "I thought you were in timber? Timberlands are safe from flood and dust storms."

"I *was* in timber. But my land has been cut over. I leased it to a lumbering company. Now the hillsides are bare, covered with black stumps. Last summer fires started in the shavings and the underbrush and burned over whole ridges. Many lakes didn't have a drop of water left in them. Now the snow and rain are at work tearing off the topsoil. You wouldn't want to look at the place; it's an eyesore.

"I should have known where those lumbermen were heading, cutting over every stick of timber and killing the small trees. But they needed timber in a hurry, and I was only too glad to have the

money it brought me at that time. The lumbering company could sell as fast as they cut, not only for homes but for newspapers. Why, do you know how much land has to be cut over to supply the pulp for one of our large Sunday newspapers? Eighty acres! And most of our newspapers are made from wood pulp. You can see what that's doing to our timberlands. This country prints more newspapers than all the rest of the world together!

"But the wasteful cutting on my property was really my fault. I left everything to the timber company. They paid me a good price for the lease. These lumbermen, most of them, expect to keep moving on and on. They cut over the hills and send their logs downstream. That's their job. They don't worry about what happens after that.

"The timber company that finished off my land has leased land farther to the northwest now. Up there they cut so many trees every week that they ran two spurs out from the railroad to help ship their logs faster to eastern lumberyards and builders. Many of your fine homes in the East are finished with Michigan timber. We had our rows of fine homes in the West too, years ago. You can

see some of them today along the boulevards of our cities. But many of us have mortgaged the property we still have.

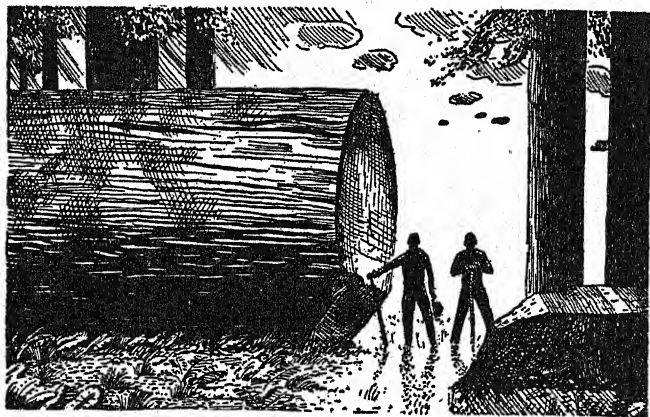
"Not long ago I decided to try to sell my land. But I couldn't—at least, not for one-tenth of what I'd paid for it. No one wanted it. Farmers couldn't use it—the soil was too acid and burned out, they said. Forest soil is often sour. Where there's plenty of rain the good minerals that are washed along over the forest floor don't stay on top; rains carry them down into the soil. In drier country, where there is light timber or grass, you are more likely to find the right soil for farms.

"Then I thought I could get a little money by selling the logging machinery the lumbermen left behind, but I couldn't. No one was interested. Too many people had the same idea. Hundreds of mills with their costly machinery are rotting away in the wasteland up there. The only things that are thriving in most of those places are the bramblebushes!

"I expect to look into the forestry business while I'm here in Washington. I'm not going to lease land to anyone again, but am going to look after it myself. I may study soil and forest control

and go into that line of work. Not much money in it, but it's my life—forests—I can't give them up.

"Some of my friends interested in timberlands are going in on this with me. Most of the lumber companies who did the cutting have kept on mov-



Primeval forests seven hundred years old falling beneath the ax.

ing west—it's 'cut out and get out' for them. They're going beyond the Rockies now that Michigan and Wisconsin are pretty well cut over. They're out there in Oregon now, some of them, at it again. This time they are cutting over mountains instead of hills—mountains of gold, green gold, I've heard people call it. The Northwest is

the land of giant trees. In Washington and Oregon Douglas firs tower two hundred feet into the air, and they tell me these forests are so thick that as you stand near one tree you can touch the next. Primeval forests, seven hundred years old! Their rings tell the story.

"But the government is stepping in more now. Many people are beginning to see what has happened to Michigan and many other states in the East and South. Some lumbering companies, too, are waking up, perhaps just in time. A few are working with the government to help save the last stand of primeval timber in Oregon and Washington. If they should cut those great mountains clean, they'll reach the Pacific, and then what? There'll be the sea ahead and deserts and floods behind them. That will be the day of reckoning!"

"I can understand," said the reporter, "how people want to build beautiful homes and lay out beautiful gardens. But when you see those same people standing by while our forests are cut out from under us all you can't help wondering what they think their children will use to build *their* homes!"

RUGGED AND RAGGED—THE SOUTHERN
MOUNTAINEER

In the same mails with the letters from Westerners, newspaper editors received letters from people who had visited farmers in the South, the rugged southern mountaineers. They, too, needed help from Uncle Sam.

Talk to a southern mountaineer whose land is run down. He owns his farm but it is a poor one. He lives in a beautiful part of the country. It is a land of natural wealth—forests, rich soil, plenty of rain, and mild winters. Yet as you look at his farm you see that trees have been cut from the hill-sides. The slopes lie almost bare, torn into gullies by heavy rains, their topsoil gone. Crops are struggling in stony ground.

In talking to the owner of this rundown farm you hear a sad story: "This is the fourth farm I've had. The others all played out. I'm thinking of moving on again, as this one I've got now is going to ruin too. I have to keep moving uphill, there's no other place to go. I'm getting near the top now. I can't be sure whether there's any land there fit to use. I have to cut down the trees first before I can tell.

"Cotton and tobacco use up the soil," he goes on to explain. "Then I can't afford to put in much fertilizer. That's why I have to keep moving along."

You look at the Southerner's farmhouse and see that it is paintless, and without a proper roof. The barn is a shack. The horse and pigs, the only animals the farmer has left, look underfed. The children playing by the roadside are thin and their clothes ragged.

III. Old Remedies Fail

HARD TIMES! YESTERDAY AND TODAY

Anyone who has read the newspapers for the past ten years has noticed that stories of this kind began to get into print. They have appeared side by side with news of the White House, polar expeditions, new state laws, or the latest improvements in automobiles. Western farmers and lumbermen stayed awake nights wondering where the good old days had gone.

But they were not the only ones. Eastern bankers and real estate investors also began to lose sleep. For years they had been lending money to farm owners of the West. They had been the bankers for large parts of the Middle West. This had come about in a natural way, for had not many Easterners wanted to go west since the days of the first thirteen states? Many who did not care to go themselves had stayed home and made money by investing in western land, lumber, and wheat. They had done this since the days of Jefferson. During the time when Jefferson was President, people in Kentucky and Virginia were

already crying for western expansion. Both bankers and farmers said bad times demanded that new country be opened up. They complained that old tobacco farms were not so rich as they once had been.

Jefferson saw that it would be wise to buy the Louisiana Territory even though he had promised the people to be economical with the small amount of money in the United States treasury at that time. When times were hard, more land gave the people fresh wealth and hope.

Before long, pioneers streamed across the mountains in hordes. Many from New England went to the Ohio Valley, leaving New England almost deserted! Others crowded the mountain passes westward. They came from all parts of the East and were soon joined by Europeans who jumped at the chance for homesteads in the rich lands newly opened up.

In 1837, again, there were hard times. Once more the cry for land was heard. Texas, Oregon, California, were opened and the country pulled itself together. Before long came the gold rush!

Hardly had the people of the country got themselves out of a bad spot when the Civil War was upon them. The "awful sixties" were at their

door. Here was trouble, indeed. Again there was the demand for land, free land. Lincoln helped to put through the Homestead Act, which gave 160 acres free to anyone wishing a farm in the Middle West. This was better, the people thought, than the earlier homesteading laws when a farmer had to buy 640 acres—and pay for them!

In 1873 came more "hard times," and further cries for land, still more land. Western farmers gradually crowded around the rich country in Oklahoma which had been reserved for the Indians. By 1890 they succeeded in forcing the government to let them in. Soon after this, six new states in the Northwest were admitted to the Union.

Railroads penetrated the West and reached the Pacific. But some of these were hardly begun before they found themselves in trouble. People and goods must be found to make them pay. A great advertising campaign began. Lands were offered for sale that were of little value. Many homeseekers bought farms only to find them worthless. Their acres fell into the hands of speculators who resold them to other hopeful homeseekers. These unfortunate people soon

found themselves bankrupt and on the verge of starvation.

In 1893 and 1907, there were still other depressions. The cry for land was heard once more. This time the government made plans for the use of some of the huge western and southwestern deserts. Millions of acres lying in dry valleys had been found to have fertile soil. Within a generation they were blossoming, their fields watered by irrigation systems.

Then came the World War. The people saw an opportunity to raise much-needed wheat to feed the armies overseas. They began to move into the dry "short-grass" lands of Wyoming, Montana, and the Dakotas. In 1918 one man alone, Tom Campbell, planned to put millions of these acres under the plow within a few years. The government would not lend him money for his huge plantings, but bankers in the East, true to tradition, were ready to help him. They lent him \$2,000,000.

All went well for one year. Then troubles began—a dry cycle was due. This turn of affairs was not expected, it was not in the bargain with the bankers! There was some rain, just enough to keep hope for the future alive. By 1929, however,

Tom Campbell's plowing came to an end. He went broke! He had plowed up 9,000,000 acres of land! But rains passed him by. His farms turned to dust!

Of course, the land of small wheat farmers in the short-grass lands fared no better. After the war came more troublesome times. Families in the Dust Bowl were starving on their own doorsteps; others, their farms ruined, moved on and became wanderers. By 1880 one-fourth of all the farmers in the United States had become tenants! By 1930 almost half of our farmlands were leased to tenants! Farmers in all parts of the country were writing to Washington to ask for new lands. But the government had no more land to give away!

BUSINESSMEN COMPLAIN—ECONOMISTS ARE
CALLED IN

Together with the stories of trouble that kept pouring from the West into the capital came pleas from businessmen in the East. Some of these men had farm machinery to sell. Some handled clothing and other goods. They complained that opportunities in the West were poor—people were not buying from eastern markets.

But loudest of all were the complaints from bankers and investors. "The money we have lent to farmers in the West to keep their homes going might just as well be sunk in the ocean for all we get back on our investments," they complained. "Many farms have two mortgages on them; and there's no sign that they'll ever be paid off. What will happen if we throw all these people out of their homes because they cannot pay us? Where will they go? And what can we do with their land if it is no good?"

President Franklin D. Roosevelt saw that the country again faced hard times, perhaps more difficult than any hard times of the past. He called to Washington men who could help him try to answer all the calls for aid. Many of them were economists, men who study ways of getting the greatest benefit for the people from money and property. They began to look our United States over. They pulled out maps and charts. "This country is a rich country—or it was," they said rather doubtfully, "and it must be restored so that it will once more be a land of wealth. Business has become badly dislocated. There has been a way out in the past, we must find a way out now. But it cannot be the same way, and it cannot

be found overnight. It will take time, much time, and many people, perhaps all the people, must help."

These economists began to study the country to see what it had been like in the early days of natural wealth—when lands, forests, and minerals were still untouched. "Though we cannot go back," they said, "to the days when only Indians lived here, we must look back to see what changes there have been. Some of the changes have been right and necessary; others have been all wrong. We must find out which ones were right and which were wrong. Then we shall be ready to do something to help us get on our feet again."

IV. The White Man in the Land of the Indians

THE LAND OF THE INDIANS

When the white man first set foot on our coast he found himself on virgin land. The country was natural, wild, unspoiled. The woods were the home of all kinds of animals and birds that were strange to him. No cities or towns, only simple Indian villages with their huts of skin or bark were to be found east of the Mississippi and west as far as Utah. The Indians who lived in the East built their tepees among trees so tall that white men were awed when they first saw them. They wrote to their friends in Europe: "The trees of this new country are so tall that their tops reach into the sky, and their trunks cannot be encircled by a man's arms!"

Pine forests covered New England. Forests covered New York State right down through every part of Manhattan. Pine and hardwood trees flourished as far south as Florida.

From the mountains and through the valleys

ran streams of cold, clear water filled with fish. Brightly speckled trout could be caught wherever water flowed. Rich beds of oysters, fish of every kind, were to be found along the coast.

Indians had hunted in these woods and fished



The Indian planted his corn in sunny spots among the trees.

in these streams for hundreds of years, yet nothing had disturbed the growing of forests, nor the great number of birds and animals living among them. Nor had anything spoiled the freshness of the water.

The ground underfoot was sacred to the Indian. To him the overturning of great stretches of

ground seemed wrong. He knew that the soil held the food that nourished all living things—trees, plants, animals, and man as well. He planted his corn, a seed here, a seed there, in open spots among the trees.

The Indian, before the coming of the white man, had no sheep, no cows, no horses, nor any animals that grazed in field or forest. He had no wagon, for he never discovered how to make a wheel. If he went anywhere he went on foot over a trail, like the deer of the woods. The trail was a leafy one. Moss and fragrant ferns crept close to its edge, and trees met overhead.

The Indian, then, was a natural part of North America. He lived in the land as he found it, without trying to change things. He understood the birds and other animals and knew their ways. Before the coming of the white man, he knew nothing about cities, factories, money, real estate, taxes. Wampum became money only after the white man arrived. Land did not "belong" to anyone, and could not be bought and sold. It belonged to all who lived upon it—plants, man, and animals. Land was for their use and it would be unthinkable to destroy the very thing that made life possible.

THE WHITE MAN ARRIVES

The white man who came to America was "civilized." For the most part he had lived in towns or villages and did not wander from place to place. Generations ago he had tamed and raised animals to live near his home, to do work for him, to be his friends and protectors or to supply him with food. Among these were the horse, donkey, dog, cat, cow, goat, pig, chickens, and ducks.

The white man had books, written records of his past through countless generations. He had large institutions such as schools, the church, government, and banks. In business, too, men worked together to control trade on land and sea.

When he came to America the white man brought with him not only his gun and feather bed, but also certain ways of doing and thinking. He wanted certain things that he had found were well thought of. If he was an adventurer, he wanted gold—gold to buy a fine ship or perhaps a place at the gay court of some European king.

If he was a farmer, he wanted land—land on which to grow crops or raise a few pigs and cows. Europe at this time was becoming crowded in

both town and country, and those who tilled the ground seemed to be getting the worst of it. They needed too many acres. Humble families had been living on the outlying fields of manors, but no longer would the wealthy owners allow anyone to use their land without paying rent.

In bygone days farmers had given the owner some of their crops or had plowed some of the owner's fields to pay him for the use of a small part of the manor. But now, more and more, these sturdy families were being forced off estates and many could find nowhere to go but to the towns. There they and their wives and children lived in miserable alleys and worked long hours in unhealthy buildings or dark coal mines.

It did not take long for the news to get around that adventurers had discovered a new land. Many farmers and their friends who could save enough money made up their minds to leave Europe. They were willing to risk their lives in thirty-foot wooden ships that had never been intended for long sea voyages. "Since life is already very hard for us," they said, "a sea voyage to an unknown land cannot be much worse. In a new country we may be able to get a fresh start on land of our own."

THE FOREST—ENEMY OF THE FARMER

The first need of the white man after his hard trip across the sea was a home and food. But he found neither ready for him. Nowhere were there any open fields for his crops. Trees grew everywhere, miles and miles of trees rustling endlessly in the wind—far more than he needed for fuel or building his home.

Besides, how could the newcomers feel safe in woods which were full of wild animals? Wolves might attack them by day or night. Indians, too, might creep out from behind trees with their bows and arrows.

To most of the settlers the forest of the new world was not a friend, but a constant enemy. They went to work at once felling trees for their homes and for a stockade to protect them from prowling animals or red men. Then they kept on cutting down the woods around their settlements to add to their safety.

When the colonists' first winter was over, still more trees were cut to clear the land for the raising of corn. Friendly Indians showed them how to plant seeds in natural open spots. But the white man preferred sowing his grain in wide cleared

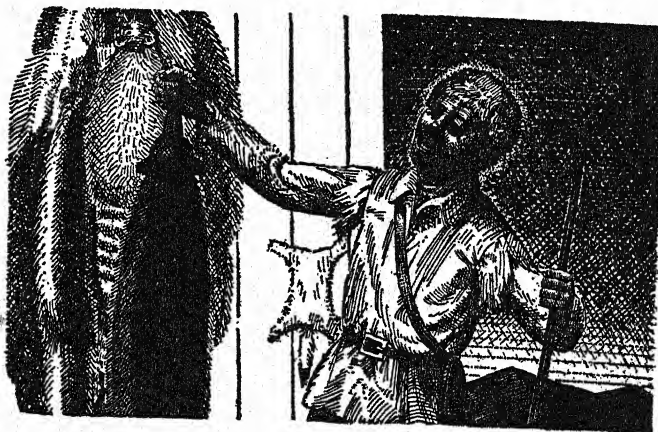
spaces, as he had been accustomed to doing in Europe. He had brought his plow with him. His forebears had used a plow for untold generations. Many of them had lived in lands where people raised grains, fruits, and vegetables because there were no woods in which to hunt for game.

Besides, grains could be stored easily over the winter and could be grown where there was not much rain. A plow might well have been on almost every American's coat of arms, if he had had one—coats of arms had, however, soon been laid aside. In America all would have equal opportunity and none need set himself above another merely because he happened to be born of a noble family.

THE FOREST—FRIEND OF THE FUR HUNTERS

Though the farmer hacked away day after day at the trees about him, not all the colonists thought of the forests as their enemy. Some found them a "gold mine." These were the hunters, those who wanted to trap fur-bearing animals for their skins. Pelts, they found, could be used as money or could be sold in Europe at good prices. In this new country hunters soon discovered that when they wanted to shoot game they could, with-

out so much as a by-your-leave. They took their guns, started out early and ranged the woods from morning till night. There was no one to stop them. Nowhere in Europe—or, for that matter, in the world, perhaps—was there such a golden



Raccoons, beaver, mink—wealth for the hunter.

harvest of furs to be had for the taking! Raccoons, beavers, minks, bears seemed to be almost as plentiful as the trees themselves.

Besides, the tall oaks, maples, pines were full of birds; the shrubs hid quail and wild turkeys. These made excellent food and could be sold to settlers at a good profit.

Of course, there had been beautiful woodlands in England, France, Germany, and other European countries where the colonists had come from. But those forests belonged to large estates. No longer could the working people go into them to cut wood or hunt, any more than the farmers were allowed to use the open fields belonging to large estates as grazing lands for their sheep or cattle.

Kings, lords, and gentlemen of wealth owned most of the forest land. They were buying it up for hunting just as they were buying up fields for their own sheep. They used the woods for their private hunting parties, and no one might enter except friends. Each lord kept a game warden or several of them. Let the poor neighboring farmer or villager be careful even if he was hungry! He must not steal out with his gun at dusk, slip into the thickets of a great estate, and make off with a quail or a hare. That would be poaching! Poachers were put in prison and left there to think over their wrongdoing.

In America pioneers found no game wardens, no overlords. To be sure, unfriendly Indians often lay in hiding to gather in a few enemy scalps. But there was less chance of being scalped than there had been in Europe of being caught poaching.

Then, too, the Indians were often friendly and went hunting with the white man to show him where the best game could be found.

HUNTERS PUSH THEIR WAY WEST

The white man who became a hunter kept pushing his way west through mountain passes. He followed streams through forests, and everywhere he felt himself the owner of this virgin land. Though he wore simple homespun and buckskin, he now walked with a spring in his step. Many a hunter at last settled down. In Europe he had worked as a farm hand or laborer, but before many years he became a respected, land-owning villager in a new country. He wrote to his friends across the sea about the land that was free or to be had at a small price.

More and more people living in the crowded countries of Europe packed their belongings into odd little trunks and chests, said farewell to their friends, and sailed across the Atlantic to America. Only the most enterprising came, for the two months' trip in sailing vessels hardly bigger than our ferryboats was something not every man or woman could live through.

THE FATHER OF WATERS

More pioneers, following on the heels of the hunters from the East, at last reached the low broad valley of the Middle West. In their path the Mississippi lay glistening in the sun. The great stream wound its way for hundreds of miles through woodland country and open field.

Every winter and spring the river, south of where it is joined by the Missouri and Ohio, spread itself out over low banks and covered wide marshlands on either side. Even during the rest of the year this lower part of the river did not keep to its course any too well! The grasslands along its banks were sandy. Many were make-shift land, and were not very firm.

The river bed, too, was sandy and uncertain. The broad stream shifted slowly year by year—in one part to the east; in another, to the west. The restless waters had been building a sandy bed for millions of years. They were still doing it. Swirling eddies piled up new sand bars and broke through old ones; full of zigzags, the river sometimes made short cuts from one loop to another, never too sure which course was best. From the east, from the west, rushing yellow streams made

their way down through mountain gorges and forest land, hurling themselves at last into the Father of Waters.

After having been in the Ohio and Mississippi valleys for a few years, the pioneers began to look about speculatively. They said to each other: "We have been here long enough to see what this river country is like. It is only in the early winter and in the spring that the Mississippi widens out. Why not make use of the rich grasslands and brushlands along its shores? Are we not wasting thousands of rich acres by putting our homes far back out of the way of the spring floods? We could grow corn and other crops on this rich soil.

"Then, too, if we build our towns out of reach of the floods, how can we use the stream to ship our goods? It would be much more economical and convenient to be right on the river. Let us build our houses high above the ground; then a little flood once in a while will do no great harm. If worst comes to worst, we can pile up banks along the river to help keep out the floods."

So the pioneers set to work on nature's sandy flood plains with as much energy as they had used in the forests to the east. Year by year more people, pushing their way on horseback and on foot,

penetrated the forests and settled down on the rich land close to the Mississippi River.

Forests gave way to forts and farms. Farms gave way to villages. A century had rolled by since Daniel Boone, gun over his shoulder, coonskin cap on his head, swung his way on foot and by grapevine toward the west.

1849! The gold rush was on! Uncle Sam would soon be giving away lands. From Europe came more and more people oppressed in the old country, free in the new. Pioneer groups had come by handfuls in 1750, but they arrived by hundreds in 1850, carrying guns, axes, plows and more plows.

At the same time, as if it were a disease, many of the children of the first hunters caught the westward fever! They left their fathers' homes and pushed on still farther west. Some sought gold, others wanted to stake out claims to timberlands in Michigan, Wisconsin, or Minnesota.

V. Ruined Acres, Murky Rivers

BARE HILLS AND SAWDUST TOWNS

All along his route, ax in hand, first the pioneer and then his sons cut over the woodlands. By 1850 whole forests were moving off mountaintops. Down the Ohio River, the Red River, the St. Louis, the Grand, the Kettle, came logs—fragrant spruce, pine, fir, red cedar; oak, hickory, hemlock.

By 1870 the streams were jammed with logs. People were no longer living in forts, they were now building frame houses; and factories were making furniture. Logs were put on rafts as long as a train of cars and sent down the Mississippi to mills and factories in St. Louis and Cairo, and towns farther south.

In the "gay nineties" it seemed as though every little stream of the beautiful forest and lake country of Minnesota and Wisconsin had its sawmills. Hundreds of them were sawing out lumber, railroad ties, piles for piers. However, while lumber was still much needed for new homes, more and more was in demand for wood pulp. Our country

was growing famous for its great newspapers and for its books and magazines.

But the cutover forest lands were not being replanted. Hills were left bare. Lumber companies moved their men from one new forest to



They cut the hills over clean.

the next. After the World War strange towns called sawdust towns were heard of through the Middle West. These once prosperous communities had shot up almost in a day. Everything in them was made of wood; and sawdust and chips were piled high in open spaces. Business boomed. They flourished for a few years, then suddenly

everything came to a standstill. The towns were deserted. The trees that built their business gone, there was nothing from which the people could make a living. The soil, it was found, was too poor for farming.

The South came next. Trees on the mountains of Kentucky and other southern states, not yet cut over or burned off, began falling before the ax. At almost the same time, not content with the South and the Middle West, lumber companies hacked their way to the Northwest!

The East, first; then the West. The South next; then the Northwest. Many a small stream in the woodlands bore witness, first by the logs carried down, then by the mud that followed, washed off from cutover hills.

The land, too, told the story. It lay bare, stumps standing, the ground strewn with dead twigs and broken limbs. In the rainy season the water, no longer held in the ground by living forest covering, cut gashes in the hills. It carried along sawdust from the sawdust towns. Once these had been busy logging centers in cool forests but, abandoned one by one, they at last became dry, lifeless, ghost towns.

LOST! A SWAMP

In the hot summer and early fall days, the cut-over hills became dry and tindery. Fires started easily. They burned their way across the deserted, barren hills. What happened along the Wisconsin River a few years ago is a case of this kind. Farmers living on good farmland began to look at neighboring swampy woodland with eager eyes. Could they not use a part of the swamp for farming if they cut it over? They had found that hay would grow very well along the edge of the marshes. In years of scant rainfall the low ground held moisture, whereas their higher fields became too dry.

Little by little, more farmers began cutting over and using adjoining parts of the woody swamp for crops. Some even built homes there. Then speculators appeared! They saw a chance for making quick money by draining and cutting over the whole woodland area. They set to work with a will. Millions of dollars were sunk in the "improvement." "We might as well make a job of it, and put the whole 800,000-acre swamp on the market," they said.

Everybody seemed in favor of the plan; but

wildlife suffered. Raccoons, beavers, quails; rabbits were killed off. Waterfowl and small birds, their nesting places gone, died or flew away.

Overnight, farmers from the East, looking for richer land, were attracted by accounts they read in the paper of the newly opened land in Wisconsin. Plots sold like hot cakes. Speculators made money. People moved in and settled down only to find that the venture was a failure! One rainy year followed another. Parts of the 800,000 acres were too wet. In drier years, parts were too dry, and most of the land was not so rich as had been thought. Indeed, more than half was not fit for raising crops. There was nothing to do but move out again!

Then the deserted swamp became a ruin—a peat desert, for most of the land was really nothing more than an old peat bed. When the rains came, the streams, no longer held in place, ran swiftly over the surface of the desolate land carrying a heavy load of mud. They flowed so fast that little water sank into the ground to feed the streams when the rainy season had passed. In dry seasons the sun burned down on the ruined countryside. Stream beds lay baked and muddy. Many

wells, in which there had been plenty of water before the swamp was drained, went dry.

One day a fire was seen on the abandoned lots. It spread, creeping along underground, deeper and deeper. The smoldering peat fire was hard to put out. Smoke filled the air. River water grew cloudy and ugly with charred wood. Mud from the blackened fields joined with refuse from the mills, darkening the streams. Land animals had long ago fled from this part of the country, and now the river fish, too, tried to escape a muddy doom.

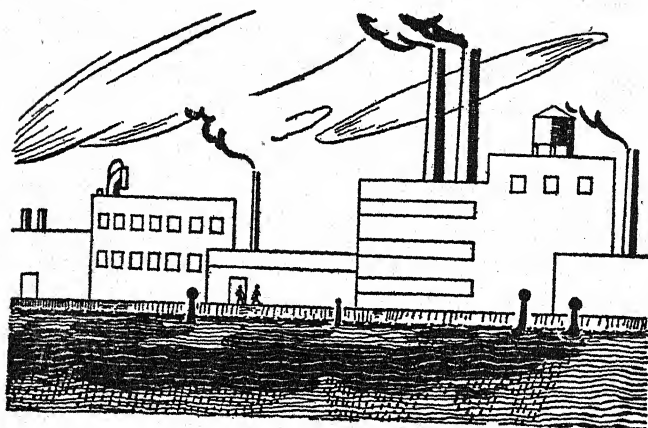
RIVER FISH IN TROUBLE

By the beginning of the twentieth century, the sportsman began to complain loudly: "Not only is the hunting bad, the fishing in this state is poor too; not at all what it used to be! Can't something be done to stop careless cities, factories, and farmers from ruining our rivers?"

But seldom, it seemed, did anyone listen to him. People had no time to bother about fish. They could eat beef and lamb. They did not try very hard to save for their tables a dish that they could do without. Yet fish have always been a natural and an important part of man's diet. They are

excellent food that costs little if streams are kept clean.

Fish live wherever there is clear water—in the sea, in lakes, in rivers. In the days of the Indian they led untroubled lives on our continent. One



Clear streams became murky with factory wastes; fish died or fled.

year, one century, was much like the next. The few the red man caught made no difference in the great numbers that filled stream and lake.

But after the white man came things were soon changed—almost overnight. The newcomer to America was a shopkeeper, a craftsman, a manufacturer. He was a trader who used coin as ex-

change. Unlike the Indian, he made goods not only for his own use, but to sell to others. He made things in quantities. Villages with small water wheels perched on a streambank soon grew to be towns with factories—for weaving goods, sawing lumber, grinding grain, smelting metals.

By 1800 the once clear streams of the East became the dumping places for wastes from factories. By 1900 rivers all over the country were cloudy with city drainage.

Factory wastes often contain copper. Fish that can survive drainage from cities die at once if there is copper in the water. A small amount kills them, as well as the tiny green plants on which young fish live. Copper is the deadly enemy of river life.

But people can survive what fish cannot. Many cities draw their drinking water from these same dirty rivers. Some towns are careful to treat the water with chlorine, and often with alum and lime besides, so that it may be safe for drinking. Then, to clear the water of any tiny vegetable growths, they may put copper sulphate into their reservoirs!

Though factory wastes destroy plants and young fish, mud, too, is bad. Mud is an enemy of

river life. It is not poison as copper and some other wastes are, but it is bad because it clouds the water. Mud shuts out light. Fish cannot live without light any more than people can. Baby fish, just as much as human babies, must have light in order to survive.

Not only must fish have light, but the plants and tiny animals which are their food must have it. Light causes plants to set free oxygen, a gas all living things need. Man cannot live without it, he would smother. A fish, too, must have oxygen—in water. There is little chance for fish near our cities of today. Many harbor waters are gloomy and dark—they are watery deserts!

Yet man loves to fish! The schoolboy or the businessman will spend hours sitting by the shore of a stream angling. Sportsmen especially complain about the poor fishing in many of our rivers. They at least have begun to look about to see who is causing the trouble. Sometimes people make fun of sportsmen, but actually we should be grateful for their interest.

THE SPORTSMAN COMPLAINS

Let the sportsman tell his side of the story.

"We sportsmen are the friends of fish. We urge

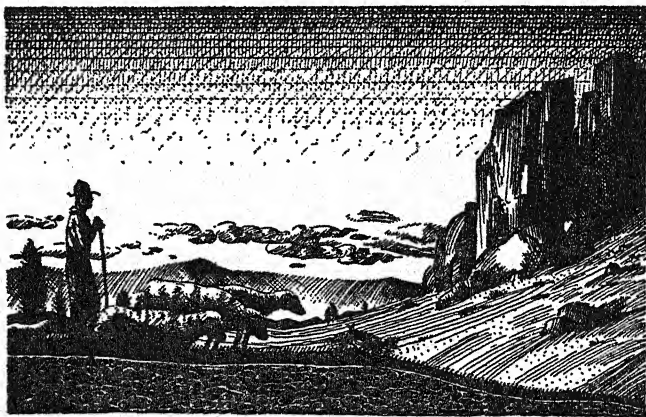
people to make laws to protect them and to keep our rivers clean. The men who never think about sea life at all are the ones who have done so much to ruin fishing. Often these men live in cities, but own land in the country. They lease their forests or farmland to others.

"Many lumber companies on leased land cut the hills over clean in order to get every bit they can from them. They leave only tree stumps, and sometimes they even set fire to these. Then the fire spreads. Seedlings are killed. The hills burn off and become charred deserts. When trees and shrubs disappear from the hills, rain begins its work of cutting gullies. It washes over the land and brings down mud and sand. The more the slopes are broken into by gullies, the more soil is brought down.

"Many a careless farmer, too, is to blame for the mud that is filling our rivers today. The farmer, especially the tenant farmer, is seldom interested in fish. His eye is on his wheat and corn. He has to raise all the crops he can to make ends meet, and he does not try to find out the best way to do it. If his farm is a large one on the western prairies, he has plowed under the grass—the buffalo grass or other kinds that used to grow wild

there. Then, unless he understands how to plow and what to plant to keep the soil rich, there is trouble. Rains tear away at the topsoil just as they do in the lumberman's part of the country.

"Cows and sheep cause trouble as well. The rancher puts too many of them on a range. They



The range was over-grazed.

eat off too much grass. Rain then washes over the cropped-off hills, and here again it brings down mud.

"What does it matter where the mud comes from, cutover forest land, farms, or grazing country? It is just as bad in any case. Every year there is more mud. Where will this end? It sometimes

seems that people no longer care whether there is fish on their table for dinner or not. Let us hope that the city-dweller will wake up before the day comes when the bill of fare no longer offers him fish, especially those found in rivers.

"Some people think that where there is a river there must be fish. But this is not so. Fish cannot live in polluted water any more than people or animals can live in foul air cut off from light. They can live only in natural waters or where man has created natural conditions.

"Land animals starve without food. River life, too, must have food. Fingerlings (baby fish) eat tiny plants and animals. These grow only in clear water through which the sun penetrates. The water must be not only clear but it must be the right temperature, for fish are cold-blooded animals.

"Government and private concerns raise fish with which to stock rivers and lakes. Perhaps you have seen a hatchery out in the country as you have driven through. But hothouse fish, as you might call them, are not so strong as fish spawned in clear natural waters. They are even less fitted to get along in streams than those which have lived all their lives in them. Man with his mud and factory wastes slaughters fish by the millions,

and then he dumps other millions of artificially raised ones into the same muddy, dirty rivers and expects them to thrive! Yet a man would not expect his dog to get along without sun and air and good food!"

VI. River Troubles

RISING WATERS

"Raging river sweeps down toward Cairo," we read in the paper one January morning in 1937. "Yellow waters of the Ohio spread out over its banks. The stream in the low country is ten miles wide. People in a small town twenty-two miles from the Ohio see the swirling river creeping up their streets.

"The great levee at Cairo where the Ohio joins the Mississippi has been dynamited. The waters flowed out over the open country to save the city of Cairo. A few farmers living in the floodway objected to having the levees dynamited. 'Why should we lose our homes to save theirs?' they shouted as they came out with guns to meet guards who went to warn them that their acres were to be flooded. Many farmers fled, but a few stayed. Airplanes can see these stranded people clinging to housetops, but no one is near to rescue them just now.

"Woman is seen on roof of her home floating down with a current running at eight miles an

hour. This is a dangerous speed for the great Mississippi.

"Cincinnati is swept by an eighty-foot flood. Cincinnati is the town where the first bathtub was built into a house in this country in 1842. Yet today there is not enough water so that her citizens may have a bath! Water is rationed, the city is in darkness, candles are the only lights.

"Many housebound people in safer places nearby are unable to go to work. They find their radios useless. One man declares he will buy an old-fashioned phonograph as soon as he can get downtown. 'Then,' he says, 'I can have some music to help while away the time during these awful floods!'

"Five gasoline tanks, washed down by the river, were chained together. They are being towed to anchor by a United States boat so that they will not cause trouble. Gasoline from tanks at Mill Creek spreads out over flood water, catches fire and moves downstream.

"People marooned in houses are swept along and some are drowned, while tobacco on a warehouse floor is saved! The floor of the warehouse works loose and is rising with the flood, so the tobacco stays dry.

"Mothers and children are taken in boats to schools and hospitals on higher places near by. One hospital has no heat, so a steam roller chugs in and is used as a furnace!



People, trees, houses, were swept along by the flood.

"Louisville is a great lake. Some think flood is not rising so fast but reports do not confirm this. Water is spreading horizontally instead.

"Three hundred women and children are marooned in a schoolhouse. Patrolman swims three-quarters of a mile through icy waters to send message to the radio relief bureau asking for food and blankets. Breaks into store. Finds telephone soaked, but manages to get word to relief bureau.

"Boats from the east are rushed to Louisville by special trains to rescue marooned people. Eastern seamen leave their jobs to go west to help the flood victims.

"People in a small town tie their boats to parking meters. Parking of boats is free! Overhead traffic signals in Main street flash green and red while river rushes by directly underneath carrying debris one way, day and night.

"Flood threatens to burst into old Shawneetown with its 1,400 residents living right below a high levee. Boats rush to the rescue. One huge scow stands by ready to carry almost the whole population of the town to safety.

"Freak weather continues. More rain or snow predicted. States along the east and west banks of the Mississippi report rainfall more than nine to eighteen inches above normal. Jacksonville, Tennessee, has 23.11 inches of rain in twenty-five days. This is more than one-half the amount that falls on the well-watered state of New York in a year."

THE MISSISSIPPI—EVERY MAN'S BUSINESS

Today the doings of the Mississippi and its branches are the most crucial in the brotherhood

of North American rivers. Why is this so? Water is food. Water means life to man, animals, and plants alike. The Mississippi with its many branches drains more than half of the whole United States. This great river system is truly the Father of Waters. From the west, its arms, starting in the wilds of the Rockies, bring down millions of gallons of water an hour. From the east, the streams that run through the mountains for hundreds of miles bring down more millions of gallons of water a day. Sands from tops of mountains in the west join with sands from the mountains of the east. Farm soil from the north joins with farm soil from the south—all washed down by the many branches of this king of rivers.

Look at a globe. You will see that in most countries each large river with its branches keeps to itself. It flows along independent of other rivers.

In the United States, however, most of the large streams join forces and carry on their work together in the great Mississippi River System. That is why everything this stream does is every man's business. Whether we live near it or not, each of us is affected by what goes on in the vast forest,

crop, or desert lands, or in the industrial centers which are drained by the Mississippi and its many branches.

But a giant of such great power, nourishing the people, giving them water to drink, moisture for their crops, power for their factories, and fish for their tables, must be treated with respect. When we see what has been going on in the valley of the Mississippi we can understand why the huge river is playing truant today, running away, tearing at stream banks and causing all kinds of trouble during high water. Not only has man mistreated the Mississippi's erratic channel, but he has brought trouble upon the country drained by the myriad tiny rivulets and branches that feed the main stream.

OLE MAN RIVER

Now, a giant river that has been badly treated becomes first a truant, but soon a tyrant! That is what is happening to the Mississippi and some of its branches. A river that naturally spreads itself out each winter and spring over miles of ground will not let itself be cramped into a narrow channel without causing trouble. During high water,

levees hold back the stream from its natural flood bed. The man-made channel causes the water to run faster.

Today this narrower channel is forced to carry off more water than came down from the hills during floodtimes in the days of the Indians. If woodlands which hold rain water in the ground are cut over, and hills laid bare; if farms are plowed under in the wrong way; if too much land is ruined by grazing of sheep or other animals that crop out the very roots of the grass, then rain runs off more quickly. It is not caught and stored in spongy woodland or grassland soil. It does not have a chance to trickle down through the ground and purify itself. Instead, it runs quickly over the surface, ripping off and carrying along mud that lies exposed.

What follows? Great quantities of the sand and mud washed off are dropped here and there as the upper streams run down toward the lower valley. As they let go of their load, the banks rise and in some places the river bed fills up. This takes place especially where there are dams. The dams, instead of collecting water, collect mud! Meantime the river flows at a higher level. Waters spread

beyond their former channels; more country is flooded.

At its worst, the raging Mississippi spreads out to a width of seventy miles in the country south of Cairo. Houses float away like bandboxes, crops are destroyed.

Farmers and their families are unable to get out of reach of the broad sweep of the current. They take to the high spots. There, with their cows and other farmyard animals which they have been able to save, they huddle together, cold, wet, hungry. They wait anxiously for a friendly boat to rescue them. To the shivering farmers, the solid ground seems gone from beneath them except for their one little island of safety. As far as the eye can see there is water—rushing muddy sea.

The many difficulties of the Mississippi River form a bad chain, each link interlocked with the next. Hills cut bare of trees, too much water, too narrow a channel, a fast current, too much mud, riverbanks too soft—added up, they make a dangerous picture.

The Father of Waters today has become Ole Man River. Unless people wake up in time, someday large parts of the Mississippi Valley may be completely swallowed in a vast flood.

GAMBLING WITH NATURE

Since 1800, river towns below Cairo have been battling for their lives. Daily they face uncertainty. So fast does the Mississippi shift its banks that when the pioneers reached the river country, the stream was flowing in a different place from the Mississippi which La Salle had found! Some parts of it had moved west, some east. The town of Hard Times in Louisiana is more than two miles west of the place where it used to be! It had to move along with the river. Its old site is now in the state of Mississippi!

Some farms that were once in Missouri are now in Illinois. Many a river farmer has moved his buildings back several times as the stream advanced into his acres. Who can tell? Perhaps someday the restless Mississippi may start moving its bed the other way again, leaving the towns behind—unless they decide to follow it back!

Each spring many people are being driven from their homes by floods which seem to grow greater year by year. Townspeople are kept busy building levees higher and higher so that whole communities will not be flooded. Near some cities the levees, already thirty feet high (and sometimes

three hundred feet broad at the base), cannot be built higher; there is not enough money to pay for this.

It costs millions of dollars to raise a levee one foot. The higher the levee the greater the cost. Besides, it is impossible in many places to build higher levees. The waters of the strong river current at floodtimes press through on the other side of the embankment and form sand bubbles. When this happens, levees are weakened.

Spillways are low open valleys behind levees, into which some of the river water may be turned by opening floodgates. They can be used with success in some places. But, while cities may be saved by opening floodgates, this is sure to mean great loss to the unfortunate farmers living on the rich lowland behind the levee.

Farmers can be helped to move from river lands to other places. Not long ago quite a number, joining discouraged farmers from the Dust Bowl, moved to the state of Washington where new croplands are now being irrigated by the Coulee Dam.

Sometimes whole towns move back from the river. Shawneetown, the oldest town in Illinois, is doing this—moving to higher land out of reach

of the swirling waters of the Ohio. Planned in 1810 by the United States government as a postal distributing center, Shawneetown was built at the time when river traffic was at its height. It was thriving when Chicago was thought to be too far away to amount to anything. But, little by little, railroads took over most of its river business.

Meantime, there was growing danger from floods. The sixty-foot levee, built to keep out the river in floodtimes, could no longer be counted on. Most of the year the river flowed along, two hundred feet away from the levee. But at flood-time during 1939 the river not only reached the levee, but its rushing yellow waters came nearly to the top of it.

A stream above a city means that the drains must be closed. If they are left open, the river rushes in. Yet if they are closed, rain water collects behind the levee.

During the 1937 flood many of Shawneetown's houses were set afloat. One straddled the railroad track. This was too much for most of the residents! They began to look about for a safer place for their town.

In moving farther back from the Ohio, Shawneetown is leaving behind a famous old bank and

other landmarks. But these are not the only things it is loath to part with. Shawneetown will have to give up its reputation of being the oldest town in Illinois! Yet it will not be the first "oldest town" to lose this honor. Kaskaskia used to be the oldest town in Illinois, but it, too, had to move away because of threatening floods.

All too often the money people would have liked to spend for schools, roads, and parks has gone into building levees. Much money is used in repairing flood damage to cities and farmland, dredging channels, and cleaning out the mud gathering in huge reservoirs behind dams in rivers. People know that great floods are natural in the Mississippi Valley, yet they insist upon carrying on their business in the river's natural flood bed! Frantically the states whose lands are in danger go on petitioning the government at Washington to help them raise their levees.

Though levee construction has been going on since 1717, United States army engineers did not come to the aid of the states until 1879. Since then, gradually, the government at Washington has been mapping out plans and helping with funds for the control of floods along most of the Mississippi River.

Meanwhile, economists look on doubtfully as levees grow higher. They shake their heads and say: "These Mississippi Valley people are risking their lives. They are gambling with nature. Their chances look worse to us than the chances taken by Italian farmers when they make their homes and plant their vineyards under the very shadow of Mount Vesuvius!"

In the 1930's flood troubles too big for the states to handle seemed to crop up all over the country almost at the same time. The Sacramento, the Connecticut, the Potomac, the Mississippi and its many branches, and other rivers all were out of hand during seasons of heavy rainfall.

In 1936 the United States government saw that it would have to help with flood control in all the great rivers of our country. More and more people lived along our important streams. More and more forests were being cut over. States, even when working together, could not raise enough money to handle their floodwater troubles.

FLOODS FROM UPSTAIRS

Suppose some morning you were awakened from sound sleep by hearing water running down through your ceiling in splashing streams. You

would probably jump out of bed, rush for some pots and pans, and set them quickly below the flood. If you lived in an apartment building, and your neighbors also shared the flood, they would do as you did.

But you and your neighbors would not run back and forth all day emptying and replacing pans as they filled! Nor would you spend your time trying to plug the holes in the ceiling that let the water through. Instead, you would do some quick thinking as to how to locate the source of the trouble.

One of you might telephone to the apartment above; another might run up to see if a pipe had broken. Another might call a plumber. You would all get together to see that the water was shut off before it ruined your ceilings and furniture and the ceilings and furniture of the people below you. Water, you would agree, should run through pipes and be delivered to tenants properly!

People everywhere know that water running into their apartments from upstairs must be stopped. They know what to do about it if something goes wrong. Yet when rivers break loose and cause floods downstream, these very people build great banks along the river and bigger and bigger

levees to hold back the water! Very few among them think of getting in touch with the people upstream to see where the water and mud are coming from. Perhaps many think that a flood is an act of God, that nothing can be done except to flee from it as from an erupting volcano or build walls ever higher to shut out the trouble.

AILING RIVERS

The once dignified Father of Waters can no longer be quieted by makeshifts. The great river is out of sorts, thrashing about in a man-made bed. A doctor is needed, many doctors, each a specialist in his own line. Today a doctor, when called in for a sick boy, examines not only the ailing head or spine, as the case may be, but he looks over all the rest of the patient's body. He studies everything around the boy—his family, his home, what he eats, the sun and air he gets, how much rest he takes.

Can a doctor for an ailing river do as much? Yes. Not one doctor, but many doctors, called economists, are doing this very thing for Ole Man River today. They have been consulted by many states as well as by our government at Washington.

Not content to study only a small part of a stream as it runs through a certain state, these economists are studying whole river systems! This is truly a gigantic problem! When you add up all the parts of our country drained by rivers you find that the sum is nearly the whole United States! For rivers can't be studied without examining the land through which they flow. This land over which the river and all its tributaries run is called a watershed. The watershed is the first thing that the river doctors examine when they set to work to study an ailing stream.

VII. Watershed Troubles

RED-LETTER PROBLEM—THE WATERSHED

Ask someone what a watershed is and what he thinks of when he hears the word. He will probably tell you something like this: "It is the land over which streams large and small run into a main stream. The word 'watershed' makes me think of drinking water."

This answer seems correct and quite simple. Yet it is but a small part of what can be said of a watershed. The whole story would fill a book, a fat one, for it is complicated and profound! We can tell only a part of it here.

Scientists know that the watershed problem is one of the red-letter problems of the day for farm, town, city, state, and federal government. Almost everything that has to do with the conservation of land and water is tied up with the watershed. Whatever happens to it affects man for better or for worse.

What would become of the drinking water of our farms and cities without a dependable watershed? What would become of the bright lights of

our streets and homes without electricity (made by water power); of our shipping carried on in rivers; of our lakes where we swim in summer and where waterfowl live or make stopovers on their trips north or south—what would become of all these without our rivers fed from never-failing watersheds?

What would become of our inland fishing, our cattle and sheep and other animals dependent on brooks and streams for much of their water, if it were not for our river and stream supply? None of these could exist.

Our very lives depend on our getting an un-failing flow of water, day by day, year in and year out. The watershed makes the river what it is just as much as does the rainfall itself. But whether a stream becomes Ole Man River or not often depends *more* on what happens to the watershed than on the amount of rain that falls on it.

SOMETHING WENT WRONG WITH THE WATERSHED

Dust storms, eroded slopes in Dakota or Nebraska farmlands mean floods or other damage for those living downstream, perhaps as far south as New Orleans.

China, a country where large numbers of peo-

ple have been living for thousands of years, has great floods. Yearly the Yellow River with its heavy load of mud spreads out over great stretches of land, often driving millions from their homes. These troubles begin far up in the bare, cutover hills. They are watershed troubles.

In the heart of the great Arabian desert lies a large town. But it is a ghost town, quite deserted. We are told that it may have been the home of the Queen of Sheba and was abandoned hundreds of years ago. Its twenty temples, shining in the hot sun, glisten like white marble as you look down on them from an airplane.

What could have happened to this town hidden in the heart of a desert? Something went wrong with the watershed. For reasons that we do not know today, the water supply, on which the ancient Arabians depended, failed. Living came to a standstill, people died or moved away.

In Syria, in Asia, the fine city of Palmyra once flourished. Today that part of the country is a desert. Something happened to the watershed. No one knows whether this took place suddenly or gradually; nor is it known whether it was caused by man or by a change in nature's water supply from rain or underground stream flow.

In the fertile Central Valley of California, where great quantities of our fruits are grown, a struggle is going on between the watershed and the sea. Because swamps along the streambanks have been drained, water is carried off too quickly to the bay; levees help to hurry it on its way. Meantime desert land lying beyond the marshes is being irrigated with river water; at the same time more and more wells are tapping the underground water supply, lowering the water table.

The valley, which never was much above sea level, is settling down. Much of it is already below sea level. Near the mouth of the Sacramento River the sea is pushing each year more strongly against levees and the underground water supply, and is slowly creeping in. Orchards and gardens are threatened.

No one can tell what the outcome will be. Engineers have a plan that might be used, but not without the help of all the people in the valley. The future of much of the valley in this watershed is very uncertain.

Coon Creek Valley is a small farming town in Wisconsin. Before the World War it was one of the most beautiful, fertile spots in our country. Farms and village thrived. But after the war it

became a place to avoid. The once well-to-do farmers who were left were discouraged, their land ruined because they tried to raise too many crops, too many cattle. Real estate slumped. Rain fell during the rainy season as it had always done, yet streams, ponds, and many wells went dry during the summer. Something had happened to the watershed!

FARMERS TURN SCIENTISTS

But Coon Creek Valley has been saved. It is once more a thriving place. How did this come about? Someone stopped to study the watershed! Those farmers in the valley who did not wish to move away got together over some books obtained from the government. In these books they read that there are good and bad ways of using land. Land, they found, could become ill just as people become ill, from improper food, from too much wear and tear. They found that rain alone cannot make a valley rich. They learned that hillside acres must be treated differently from flat country; that wells and rivers will run dry unless water is held in the ground to feed them.

The farmers hurried from their books to do something to heal the valley. They gave them-

selves a "course in scientific farming." In other words, they became scientists. The United States government and the state of Wisconsin helped them both with money and with men who could advise. This was the turning point for Coon Creek Valley.

Today the watershed of this town is safeguarded. As long as the people living in it keep forests growing on the hillsides; plow around the curves of the slopes instead of up and down; hold back water during the rainy weather, storing it in lakes and ponds for the dry season; and follow other rules of "land hygiene," all will go well.

HIDDEN RIVERS, HIDDEN LAKES

A watershed is not only the land over which waters run into a main stream, it is made up of the solid hills themselves, from the trees and grass growing on them right down through the ground below them. A watershed has depth just as a river or a lake has depth. What lies under the ground, the water held in it, and what goes on there—all these affect the farmer. They affect everyone who depends on that watershed for drinking water, crops, fishing, or anything else that has to do with water.

Not all watersheds are of great use to man for farming. The glistening white rocky sides of parts of the Yosemite Valley will grow neither crops nor forests no matter how much rain falls. On the other hand, a watershed having only a fair amount of rain may yet grow excellent food crops and trees if there is good deep topsoil and if the people living on it know how to make the most of the rains they receive.

A watershed must be able to hold its water throughout the year. If rain falls only in winter and spring, then the watershed may be dry in summer unless there has been some way of storing the water. Trees and plant roots, dead leaves, and topsoil hold a great deal in their spongelike mass.

The subsoil (the rather stony soil that lies below the topsoil) also holds water. But much goes still farther down. It sinks deep into the ground and forms hidden rivers and lakes. The top of this water is called the water table. Like a bank account on which man may draw when his ready cash is spent, underground water can be brought up and used when there is little rain, or when surface waters are not safe for drinking. In cities little use is made of natural streams flowing beneath them. This water would not be good

enough to drink. But water pumped from artesian wells a few miles away is often piped to cities from storage lakes.

The farmer living in a dry open valley is the one who depends almost entirely on the water supply lying under his farm. Perhaps there is a stream near his home, but it is not clean. Perhaps there is no stream at all on his farm. Where is he to get water for daily use if not from a well? He knows that well water, since it taps the underground supply, is usually pure and more dependable in flow than stream water. A prairie farm without stream or well is about as useful to man as a pond without water is to a fish.

But underground water also has to be protected. It, too, comes from rain water. And just as surface water grows less in dry seasons, so underground water grows less when it is not supplied over a large area from above.

Natural reservoirs below the ground are well protected from sun and air. Their waters are often icy cold and flow far beyond rainy parts of the country. They creep along under dry fields and even deserts. The hotter the desert the lower the water table, as a rule. But it is there! Indeed, water runs at two or more levels. If it gives out at

one level, there is still a lower one and no man knows how deep down the lowest reservoir lies hidden.

Men who can find ways of tapping underground water may become more famous than men who find gold fields. Not so long ago an Italian family that had lived in California for twenty years moved to a place five miles east of Tripoli in northern Africa. They wanted to see what they could do to reclaim land which was a part of the world's greatest desert. They found themselves on the very edge of the vast Sahara. Wasteland covered with scrubby bushes and desert plants stretched for miles into the distance. But the Italians from California drilled for water. They struck it at fifty-four feet.

From then on their success in well digging and growing of trees and gardens in deserts was certain. They found themselves famous. Though in many places they have had to drill a third of a mile before striking water, yet water they have found! Who can tell how far that hidden water may have traveled before it was brought to the surface by the enterprising Californians?

But deep wells are expensive. Moreover, the water table may drop if surface waters fail. In the

dry farmlands of the Dakotas and three or four states south of them, the water table sank from eight to seventeen feet between 1934 and 1936. Why was this? The soil covering of the watershed had been plowed under or grazed over. The hot sun burned down on the open ground. There was no longer a protective grass coat to hold water and let it trickle down through the roots to the earth below. Instead, it ran off quickly over a baked, tightly packed surface, and that which remained soon dried out. During periods of rainfall there were floods along rivers. But there was much waste of water, too, by those using it for irrigation. Streams failed, lakes dried up. In some parts of South Dakota the underground water dropped as much as forty feet in twenty years!

VIII. The Ground Under Our Feet

OF MORE VALUE THAN GOLD

We all know what it means to economize. We economize in time; we economize in such things as fuel and clothes; we keep the meat that is left over from one meal for another meal. We save because things cost money that it takes our time or someone else's to earn. It is not the money itself that we really want, but the things it will buy for us—three meals a day, a roof over our heads, clothes to wear.

Usually the harder a thing is to get the more careful we are not to waste it. Such things as old papers, boxes, and string are often thrown away because they cost so little. But if someday the wood from which these things are made should become scarce, and we had to pay five cents to buy a daily newspaper or fifteen cents for a little ball of string, we would begin saving old paper and odd bits of string right away.

During the days of the early settlers wild turkeys and ducks could be had free by anyone who could shoot them. Later, when more settlers began

to pour into our country, these birds became more scarce. You had to pay twenty-five cents for a fowl in the market. Today in the same parts of the country you probably cannot buy a wild turkey or duck at any price, but you buy a fowl that has been raised on a duck or turkey farm at anywhere from twenty to fifty cents a pound!

What you pay for a thing today is all a matter of how much of that thing there is and how many people want it. Even water is no longer free. Safe, clean drinking water could be found almost anywhere until about a hundred years ago. Twenty-five years ago one could still drink from some mountain brooks in the East with safety, but today, because of the many people using our land, stream water is almost everywhere polluted. Our large cities and towns build purifying plants to make sure that water is safe, and we all pay for these in taxes.

Much the same thing is true of all our natural resources—forests, wildlife, and even soil; they are no longer free or even to be had for little money. "Cheap as dirt" is an old expression. In many places today even dirt is no longer cheap! Much of our desirable land has buildings, crops, or forests on it. Besides, much topsoil has been

wasted and is still being wasted by owners who either have not had an opportunity to learn how to care for natural resources or are not farseeing enough to understand that the waste means loss of profit for them.

Land with good topsoil is precious. The farmer must learn farm economy if "the good life" is to go on. All the money in the world will not help him if his acres have turned to dust because he has not saved the rain water that fell during the spring. Gold will not restore the soil that has blown from his dried-out land to some other part of the country.

If the farmer wishes to live he must learn to guard his water supply so that his well will not run dry or his streams fill with mud. He must learn not to cut away trees and shrubs on steep hillsides. If he cuts them over, rain water soon gashes the soil and tears it off, while at the same time little soaks into the ground for use during dry weather.

The farmer must learn that rain water will run down hillsides even faster if he plows his fields up and down the slope. Water quickly finds the furrows and carries the precious topsoil away with it.

The farmer has to learn that rain water on a slope must be caught. If he plows his furrows round the curve, and plants grassy strips every few feet so that they will soak up water like a sponge, he will save both soil and water. If, besides, he stores rain water in a pond by damming his stream he will have enough for crops and live-stock through summer months.

The farmer in dry country must save water; but the farmer in any part of any country must save his soil. Water that is wasted will evaporate and return again to the earth as rain or snow, but with soil the story is different. Once it has been washed off into the sea it is gone forever within the period of man's stay on this earth.

If you want to see what happens to soil when water moves down hill, try an experiment. Take a piece of glass about a foot square and cover it with two inches of loose soil. Cover another piece of glass with sod (growing grass, together with its roots and earth) dug up from a field. Sprinkle both at the same time with a sprinkling can. On which piece of glass does the water begin at once to wash out the earth?

Then, as you go on watering the earth, raise each of the two pieces of glass about three inches

at one end. Little streams now begin to cut their way through the soil. You can see that the runoff is faster on both pieces than when they were level, but much faster where there are no spongy roots to keep the earth together and hold the water.

MIGS

What affects the farmer in the country affects the man in the city who depends on him. If farmers have poor wheat and corn crops, banks and wheat markets may slump. When farmers fail and their land is ruined, the state must support them. It must help them on their run-down farms or show them how to build them up once more; or it may move the farmers to some other place. They and their families cannot be left to starve.

Today there is almost no opportunity for a farmer to leave his run-down farm and move on onto a better one as his forefathers did. The old frontiers are gone. Our country is built up. Not even with a microscope can anyone discover new acres that have rich natural soil fed by clear streams. Pioneers found them, settled on them. Many ruined them and moved on. Within the last generation their children, whose farms have be-

come too run-down to support them, have found that there are no new lands beyond.

Thousands of them are still "moving on" with no hope of ever finding a home. Other thousands who worked on farms have lost their jobs because



They became wanderers.

the "all-purpose" tractor has invaded the West and South.

All-purpose tractors first began to appear on the market in about 1915. Today these farm robots have taken over the work of large numbers of horses and men. When we hear people speak of the machine age we are more likely to think of

cities and factories, but today the machine age affects farm and city alike. A modern tractor can plow fields and plant the seeds; it can cut and thresh wheat or cut and bind grain at one operation. It can pick two rows of corn or dig up two rows of potatoes at the same time.

Life is more quiet for the tractor-driving farmer on his thousand-acre farm than it used to be when many men and horses worked together. To liven things up, tractors sometimes have radios attached to them. In this way the farmer can keep in touch with what is going on in the world.

A certain farmer who employed a hundred and sixty families to help him, bought several tractors. He then dismissed all but thirty families. Numbers of these unfortunate farmers did not know where to go. They became wanderers.

The machine should not be blamed for putting men out of work. Rather, some arrangement must be made so that there is other work for the jobless. Many a farmer of today who employs men is himself having a hard time to make ends meet. Perhaps he has had poor crops, or he has not found a market for his crops. Perhaps he has heavy tax bills staring him in the face and his home is mortgaged. The soil on his acres may be run-

down and he can count on only fourteen bushels of corn per acre when he used to get fifty bushels! If a machine will help him cut down his payroll and the expense of keeping horses, he buys the tractor, sells his horses, and lets his men go.

Of course, there is something wrong when soil that was once rich has become run-down. There is something wrong when the water table has dropped ten feet or more so that the earth is too dry to raise good crops or any crops at all!

Many farmers in various parts of the country have not known how to save their acres from being washed or blown away. The long dry spell which began in 1929 awakened counties and states. They began to realize that farmers must be shown how to care for their land. The federal government, in turn, could not stand by and see thousands of acres in the prairies turn to dust without coming to the aid of the struggling states.

The government at Washington is trying to look ahead to see what foreign or home markets there are for crops. If markets are poor and if the farmer's land is run down or dried out, the government often pays him not to plow all his land, but to plant cover crops, such as clover, to hold the soil in place. It also sends men who show him

how to nurse his acres back to health. Unless this help is given, more farmers, whose property is heavily mortgaged and who can see no way of making a living, will be forced to give up their land. They may then have to join the farm workers they themselves have dismissed when they bought a tractor to reduce expenses!

Among the thousands and thousands of American farm families driven from their homes, many a man and his wife have only one refuge—an old automobile. On it are strapped mattresses and perhaps an old stove. All their other worldly goods are tucked away inside and sitting among them are their thin, untidy children.

The "Migs," as these wandering families are called, move from place to place during the harvest season in the Middle West and Far West. Many of them can find work on large fruit farms, especially in California. Starting in the Imperial Valley, they gather lettuce, peas, and canteloupes; later, fruits in the Sacramento Valley, farther north; still later, grapes. Some go on into Washington and Oregon for the hop and berry crops, and toward the end of the harvest season they return to Arizona where they finish up with cotton.

These Migs have no "headquarters." Their

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Of course, there is something wrong when soil that was once rich has become run-down. There is something wrong when the water table has dropped ten feet or more so that the earth is too dry to raise good crops or any crops at all!

Many farmers in various parts of the country have not known how to save their acres from being washed or blown away. The long dry spell which began in 1929 awakened counties and states. They began to realize that farmers must be shown how to care for their land. The federal government, in turn, could not stand by and see thousands of acres in the prairies turn to dust without coming to the aid of the struggling states.

The government at Washington is trying to look ahead to see what foreign or home markets there are for crops. If markets are poor and if the farmer's land is run down or dried out, the government often pays him not to plow all his land, but to plant cover crops, such as clover, to hold the soil in place. It also sends men who show him

how to nurse his acres back to health. Unless this help is given, more farmers, whose property is heavily mortgaged and who can see no way of making a living, will be forced to give up their land. They may then have to join the farm workers they themselves have dismissed when they bought a tractor to reduce expenses!

Among the thousands and thousands of American farm families driven from their homes, many a man and his wife have only one refuge—an old automobile. On it are strapped mattresses and perhaps an old stove. All their other worldly goods are tucked away inside and sitting among them are their thin, untidy children.

The, "Migs," as these wandering families are called, move from place to place during the harvest season in the Middle West and Far West. Many of them can find work on large fruit farms, especially in California. Starting in the Imperial Valley, they gather lettuce, peas, and canteloupes; later, fruits in the Sacramento Valley, farther north; still later, grapes. Some go on into Washington and Oregon for the hop and berry crops, and toward the end of the harvest season they return to Arizona where they finish up with cotton.

These Migs have no "headquarters." Their

children seldom attend school longer than a few weeks at a time; they are often half starved for months, since they earn little. The breadwinner of a family of small children may make 75 cents a day. If he is gathering cotton he may make only 45 cents; that is the payment for picking a hundred pounds—a day's work. He is often too proud to accept relief money. He and his family prefer to struggle along on his small earnings. Besides, moving about as he does, he has no permanent home in any particular state and so cannot obtain relief money. Relief is usually given only to residents.

The Mig has to spend about three dollars a month for a camping site; he must buy gasoline for his car, for without it he could not move to the next harvest where he can find work. During the winter it is impossible for him to make a living, so he must see to it that his summer earnings last.

Without the Migs, the fruits we are used to having on our tables might no longer reach us. Harvests covering hundreds of acres need many hands to gather them before they spoil in the burning western sun. Yet the Migs are not wanted in California—after the fruits have been gathered. Many

of them were once landowners; today they camp during the winter in the open in Arizona or other states where they can find campsites that will take them.

NO SOIL, NO LIFE

Great rivers that are subject to floods carry along mud. There is nothing strange about this, yet today in our country there is something unnatural about it. The unnatural part is not that there is mud in the streams, but that there is so much of it all year round, and it is coming down so fast. Many people do not know that there is danger to our whole country in this, just as there is danger to homes if floods constantly wash at their foundations. Soil means life. Without it, where would our food grow? What would become of animals? They, too, depend on plants for food and shelter.

"But is not soil on the earth deep?" you ask. "Anywhere one digs there is soil below, isn't there? The earth is millions of years old. Think of the work that rain, rivers, and wind must have done in all that time to make soil! Think of all the plants that have grown on the earth and died.

They have helped to make soil. There *must* be plenty of it."

Wherever many people make their homes you may dig and find soil; but that is because people live where plants and trees can grow, where there is good soil. People cannot make their homes in desolate places, such as the stony mountainsides of the vast Rockies, nor can they thrive in sandy deserts where little or nothing can grow.

SOIL—MANY KINDS

All soils are by no means good soils. The dried-out bed of an old salt lake would be a poor place to try to start a garden! Nothing would grow in it. We can compare soil with milk. Rich milk has heavy cream on top; skimmed milk is without cream.

Look at the ground as men make a hole in which to plant a large tree. The first thing they take up is a square of sod. Though the grass looks quiet, what do you see when the spade lifts out a piece and overturns it on the ground? You see dark, rich soil. As you look at it you notice that the sod is alive! Worms dangle from it, tiny bugs scurry about in the dark-brown matlike square. In the fine dense roots that have lain hidden for

so long, living things find both food and home.

You move up to look into the hole as it grows deeper. Below the sod and topsoil you see coarser, more sandy earth. It is probably lighter in color and contains more stones but fewer worms and insects. This is subsoil. It helps to hold water which soaks down through the sod. But for raising fine pumpkins and beans? It would not do at all!

As the hole grows deeper the soil becomes still coarser; there are even more stones, perhaps broken pieces of rock. All at once the spade may strike solid rock. You would not try to raise even a weed in such stony soil!

Rich topsoil in which growing things thrive is full of fallen leaves, roots, and parts of dead trees; or it may be made mostly of grass, small plants, and roots. All these decay slowly, helped by rain soaking down through them. Minerals in the trickling water help to make soil rich. Tiny living bodies (microorganisms) are very important too. They change decaying plant and animal life into a form which seeds and growing plants can use for food.

Even worms have much to do with making soil rich. They not only take it into their bodies and discard it in a richer form, but they keep the

earth loose. They constantly move about tunneling their way through the ground, making openings through which water can work its way.

Nature left to herself carries on steadily her work of making topsoil. The underground world is something like a factory whose doors never close and whose workers are always busy. Topsoil has to be built. Time is a slow builder since living things are needed for the work. Only during flood or drought is there any delay, or when man interferes and allows the soil to be eroded, that is, washed or blown away.

SOIL WASHING OUT FROM UNDER US

There are many kinds of erosion. Sheet erosion is the worst. Since it cannot be seen, it does the most harm. Sheet erosion is the washing off of soil evenly over a large area. The farmer may not know what is happening until patches of lighter colored subsoil, or even rock, appear in his fields. Where land slopes only a little, sheet erosion works more slowly and easily goes unnoticed. It is noticed sooner on steeper land where rain runs off more quickly. Once the topsoil and the roots that hold it together are gone, the subsoil begins to move even more quickly.

During a severe rain, sheet erosion may change to shoestring erosion on either topsoil or subsoil. This can be readily seen. Tiny rivulets eat their way into the surface making long narrow stringy cuts that look like shoestrings. If the farmer leaves these and does nothing to stop them, they may grow deeper and become gullies. Gullies more than a hundred feet in depth have been cut in some parts of our country. In one part of Georgia 40,000 acres were cut into deep gullies in forty years. The land is now useless except where the government has stopped the cutting.

Topsoil is the lifeblood of our country. It is being wasted by people who would not think of wasting money, because they do not know any better. Few of us stop to think that, though there are plenty of rock formations on and in the earth, living things are few by comparison. Trees, plants, and animals grow only near or on the surface, for they need sun and air. How can we afford to waste the topsoil, built up by them, which makes life possible?



The lower Mississippi is naturally a wandering stream. It builds up banks and makes many S

turns. Sometimes the neck of land in a turn may be only half a mile wide. Now and then the river shortens itself by cutting across a neck.

People living along the Mississippi many years ago noticed what the river did. They said: "A shorter stream will save our riverboats many hours in delivering our goods. We, too, will make cross cuts."

They have been doing this from time to time ever since. Occasionally by digging a little way into a neck they found that the river would finish their work. So far more than a dozen cuts have been made, shortening the stream by at least two hundred and forty miles.

Two things happened when the Mississippi was shortened. The current speeded up. Whereas in some places it used to run at the rate of five miles an hour in its winding bed, its speed is now about fifteen miles an hour. This shortened stream no longer enriches so much of the land along its banks as it used to. A slowly meandering river, carrying mud, drops silt here and there a little at a time. But a rushing stream tears at banks and sweeps mud along in great quantities. As we have read, levees do not make matters any better if we are thinking about the saving of our topsoil.

Meantime, more and more people are living in our country. More and more farmers are plowing up land without knowing how to save the soil. Our country is moving fast—from beneath our feet—washed out by water, blown a mile or more into the air. It is scattered to the four winds; it is hurried to our oceans never to return. What chance is there for Nature to build new topsoil where such odds are against her?

Nature is thrifty. Before man began plowing the earth, she managed her building up and her tearing down well; her building went faster on the whole than her destruction. Her budget had a favorable balance! Rains wore away rocks: sandstone and granite crumbled and became a sandy mixture; slate became clay. All kinds of rocks containing iron and other minerals wore down slowly. Their sands joined. Trees and plants decayed and formed rich topsoil, and roots held the earth together. Only a small amount of soil reached the sea.

If more had been washed into the ocean than stayed on the land, soil could never have been built. Rivers during natural floodtimes used to be bordered by grasslands and forests. Most of the mud these waters brought with them was

caught in the grass and tree roots. It built new soil slowly, so slowly that it changed the surface of the country very little in any one year. Yet that slow, natural building was fast work compared with the amount of building we are allowing Nature to do today!



Many countries are crowded for land. In some parts of the world there is no longer enough good soil in which trees or plants can grow.

In northern China hundreds of years ago mountains were covered with trees. But people, chopped them down to lay out farms; little by little they cut many of the mountains clean. Slowly the soil, open to rains, washed down. No one took time to plant the right bushes or trees to hold it. Here gullies are six hundred feet deep today. The mountains lie barren or covered with scrub—worthless, some may say, yet precious, for those scrubby bushes are starting to build topsoil once more; until the earth becomes richer, nothing better will take root. The people who once lived in these parts of China's hilly country are gone. They will never return, nor will others go

there, for when soil leaves the country man and animals must go too.

There is still much good soil left in our own land, but tomorrow there will be less. The day after tomorrow there will be still less. If someone were to tell you that all New England, New York, New Jersey, and the two Virginias had been ruined, you would be shocked. Yet as much land in our country as there is in these states has lost its topsoil and is today a waste. This ruin of our natural wealth will go on as long as people leave the surface of the ground open without doing anything to stop wind and water from tearing away the soil.

TEN THOUSAND YEARS TO MAKE ONE FOOT OF TOPSOIL

How long does it take to make good topsoil? Soil scientists tell us that one inch in five hundred years is about the average. A good way to see how long it has taken to build good topsoil in our country is to look at some that has formed since the last glacier.

You probably know that glaciers came down over parts of our country, Canada, and Europe thousands of years ago. The last one covering the

northern part of the United States ended north of the Missouri and Ohio rivers in the Middle West and at Long Island and Staten Island in the East. It began to disappear from there about 25,000 years ago. As the weather grew warmer, sand, pebbles, and boulders that the frozen mass had scratched off mountains and hills melted their way down through the ice and lay in heaps. They can be found in many places undisturbed to this very day.

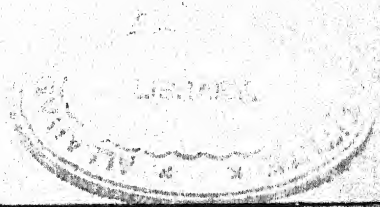
On top of these glacial sands lies a layer of dark topsoil. This is soil that has been formed by decayed plant and animal life that crept north over the glacial sands as the cold weather gave way to warmer days. It is easy to find out how deep this is. If you live near New York, take a boat to Long Island or to Staten Island. Here, where the glacier ended in the East, it left the most sand. Wherever a road cuts through the sand hills, stop and look at the sides of the cut. You see round pebbles, large and small, scattered through the light-colored sand. On top of the hill, grass or small trees are growing in dark topsoil scarcely a foot deep. As you look at it you say: "Is that all the topsoil that has been built since the last glacier thousands of years ago?"

Of course, the topsoil could not begin forming until the glacier had melted back far enough toward the north so that the air had become warm. Plants could not begin to grow until the icy weather had passed. Scientists tell us it must have taken about 10,000 years to make this foot of topsoil that we see today.

CANADIAN ROCKS TRAVEL SOUTH TO
NEW ENGLAND

The last glacier covered Long Island and Staten Island with sand and some well-worn stones, but mostly it left rocks and pebbles in New England. Some were as large as Plymouth Rock, others were much larger. Then there were tons and tons of pebbles! These may have started out as good-sized chunks of mountainsides in northern Canada, but by the time they had ground against one another and were delivered to New England they were small—though just as hard!

In Massachusetts today the topsoil lies on these pebbles and stones mixed with sand. The first plants that tried to grow in this part of the country after the glacier had a struggle! They found a stony welcome! For this reason, topsoil was built very slowly here from century to century. When



the Pilgrims reached New England and tried to raise crops, they found the soil thin. They wrestled with the rocks. As you drive through New England farmlands today you exclaim: "What pretty stone walls between the fields!"

But the farmers did not have the scenery in mind when they built those walls! Walls were one way of getting rid of boulders. Farmers wanted to be able to plow a straight furrow and they wanted a crop of something besides stones!

RICH LAND, BOTTOMLESS SOIL

Though decayed plant and animal life help to make the best topsoil, some glacial soil may be good for growing things. It is often hundreds of feet deep.

"The last glacier," the scientist will tell you, "was not the only one that ever visited our country. However, we know the most about it since it was the most recent! There have been at least three other glaciers before the last one.

"Cold weather works its way down from the north about every 125,000 years and great masses of ice form on the land. Four times these have ground their way down from Canada; four times they have brought with them rocks, pebbles, soil.

In many places north of the Ohio and Missouri rivers' glacial soils lie in deep layers one on top of the other as in a layer cake. In parts of the Middle West there is soil so deep that it appears to be bottomless. However, nothing of much use to the farmer, we agree, was left in New England by any of those glaciers!"

IX. Sentinels Guard Us

WHAT HOLDS THE WORLD TOGETHER?

Trees were here on this earth before man came. They will probably be here after man is gone, for they are more used to this world than man is. Trees are older than any animal life of the kind that we know today. They covered large parts of the land long before the days of dinosaurs. What is more, forests can get along very well without man, but man cannot get along without forests!

If all the world were made of hard bare rocks alone, a watershed would be very different from a watershed as we know it. It would, indeed, shed water rapidly! Nothing would grow on it—no plants, no trees. Nor would there exist animals such as are found on our earth now or that have lived here in the past. They all depend on soil and plant life.

During the whole period when animals and man developed, the rocky foundation of the earth was well covered with soil. Endless plants grew in it. Primitive man used many of them for food.

Trees were man's home. He lived among their branches, came down from them to swim in the river, scrambled back into them when an enemy attacked him. Then from his hiding place he threw stones at the intruder below.

Today we no longer climb trees to escape an enemy. Often we do not even build our homes of wood or burn wood for fuel. Brick, stone, iron, copper, are frequently used for buildings; coal or oil for heating them. Yet wood will always be needed for furniture, finishings in homes, floors, poles, railroad ties, and many other things.

Trees are lords of the earth. They and their small neighbors, the shrubs, and their very small neighbors, the grass and moss, have always shared the job of "holding the earth together." If they had not done so, the animals that we see about us could not have existed. Animals depend on living things for food, and on water for drinking. Plants and roots supply much of the food, and trees guard the water.

Without trees, many rivers would flow only during rainy weather. Where are the beginnings of the large streams that run through our cities? If you have been in the mountains you may have seen there the little brooks that feed them. If you

had time to search out all the brooklets that make a river you would find hundreds of them. They ripple along through wooded valleys high in the hills, and slowly wind their way down to larger streams.

You have probably noticed that it is cooler in the woods than out in the sunshine. That is because trees keep out much of the sun, and they send out moisture through their leaves. This cools the air. Cooler air protects streams and the forest floor so that their water does not dry up so quickly.

The roots of trees help to keep the soil loose. They allow raindrops to trickle down into the earth. Below the ground lies man's unfailing reservoir—that is, if he respects plants and trees which hold soil where it is. Without forests there would be no steady flow of drinking water, during dry hot seasons, in rivers either above or below the ground. Trees spell *drinking water*.

A forest is one of our best friends, yet until the last few years the "man in the street" has hardly given the matter a thought. That is probably because the man in the street is a city man. He seldom sees trees except in parks. It may be that he spends his days in a skyscraper office fitted out

with steel and composition furniture. Even the flagpole on the building and the water cooler near the elevator are steel. The floor under his feet is cement, covered with linoleum. He is far from trees and the thought of them.



Lumber booms, land booms are over.

This man does not turn a hair when he reads of lumber barons cutting over mountains of first-growth trees, and leaving the ground bare. A forest fire means little to him unless the smoke blows over his city and annoys him. That is because he still thinks that trees grow everywhere outside of cities and are not in need of any special attention. He does not see why a few hundred acres

burned over will do any great harm. He has no clear idea of what a watershed is and how his life depends upon it for protection. He does not know that cutover hillside ground is not good for farming.

We can understand that this man (like the people of Boston who asked what the red fog was) is not aware of what is going on in his own country. He does not realize that boom days are over, that lumber booms, land booms, cattle booms, gold booms are as out of date as a horse-drawn coach. He has hardly heard the word "conservation." Yet he feels himself up to date in his modern office!

GUARDIANS OF OUR WATERSHEDS

Trees grow on watersheds. More than half the timberland of our country is of great importance to these watersheds. Trees are sentinels that guard the mountains and the mountain streams all the year round. One-third of our country is protected by them—about 615,000,000 acres. Some of these acres are run-down. They were cut over and sometimes burned out afterward, but on maps they are still marked "forests."

Who is looking after these forests which are

guardians of our watersheds? The United States government is practicing forestry on 140,000,000 of the 458,000,000 acres that affect watersheds. These acres are well cared for and their trees and wildlife protected.



Guardians of our watersheds.

Four hundred million acres of forests are owned by private companies. They may be used as the owners please. Only a handful of them—24,000,000 acres—are well looked after. These forests lie in various parts of our country. Under their present owners the trees are cut only when they are "ripe."

A ripe tree is one that has reached its best growth. Foresters can tell pretty well whether a tree is old or young or middle-aged. They do it as easily as you or I can tell something about the age of people. Trees look different at different ages. The growing ponderosa pine of the dry Rocky Mountain plateau comes to a point at the top, while the crown of a pine that has stopped growing flattens out. In addition, the branches of an old ponderosa droop; the bark is smooth.

“CUT OUT AND GET OUT”—THEN WHAT?

But what of the other millions of acres belonging to private concerns? Only time can tell. Their owners are interested in making quick profit from their timber. Many of these acres are being cut over in the same cut-out-and-get-out fashion used by the old lumbermen. These fast-moving fellows cut off everything and left only stumps and slash. Young trees and seedlings were trampled down. Often the whole mountain was burned off.

As long as watersheds are in private hands the owners of those acres control the fortunes or misfortunes of thousands of people. Why is this allowed? Owners have taxes to pay; and lumbermen must receive their salaries. A profit must be made.

Logging is just as much an industry as manufacturing spades or parts of automobiles. In the early days there was seldom any thought for the future since more land was to be had elsewhere. Now people are beginning to realize that good "land beyond" no longer exists, and that it is important to make the best of land here and now.

What becomes of the cutover acres? The lumber baron, or small woodland owner often sells them to farmers who do not know that the property may be worthless for growing crops. A new owner finds this out too late. Taxes on his acres must be paid or the land becomes tax-delinquent. In 1935 there were 50 million acres of tax-delinquent forest lands in our country. Often whole towns went bankrupt when the lumber industry played out. Millions of acres of useless cutover land returned to the care of Uncle Sam because the owners could find no buyers.

Sometimes an owner, hoping for better days, takes out a mortgage rather than sell. He may even take out a second mortgage. But unless he learns how to use his acres with profit, there is no hope ahead. The land falls into the hands of the bank that holds the mortgages.

CITY BUILDING AND CLEAN WATER DO NOT
GO TOGETHER

Engineers long ago found that city building and clean water do not go together. Tiny typhus germs in streams near cities, while they cannot be seen in a glass of clear water, are deadly enemies of man. River mud, though easily seen, may be harmless enough, but most people do not care for mud in their drinking water! They are not like the old pilot of the Mississippi steamboat days who, we are told, drank his glass of cloudy river water without hesitation even though it held "an acre of mud" from the Missouri.

New York City secures its water from the hills to the north of it, the Catskills, as well as the uplands of Westchester County. These two watersheds are guarded as a treasure by laws and patrols. Forests successfully hold back the rain-water, preventing great floods and ensuring a dependable flow for the city throughout the year. Among the hills water is stored in great reservoirs until needed; a purifying plant aerates and cleanses every drop before it is piped to the city.

Though New York State was in the lead in securing a safe water supply for the people of its

greatest city, yet as recently as 1850 the forests on its watersheds were being cut over, leaving many hills bare. There was a lumber boom. In those days more timber was cut in the Empire State than in any other in the Union.

But the timber boom did not last. Lumbermen moved on, farther west. Today little logging is carried on in New York State. The forests are still "coming back." However, more than half the area is once more covered with forests and watersheds are well protected.

LAWS PROTECT, BUT EVEN LAWS MUST BE
PROTECTED

Intelligent citizens make a great struggle to secure laws for the protection of watersheds. The public must first be educated to the value of the watershed and this takes time. Usually people wake up only after there have been difficulties with floods or drinking water purity. But even when the laws are finally passed that is not the end of the matter! Another struggle begins promptly—to protect the laws.

There is no such thing as permanent protection without constant vigilance. From time to time private persons get together and try to have the

laws for watershed protection changed. They grow tired of so much "protection." "No Trespassing" and "No Hunting" signs on state-owned land displease them. They look longingly at the mountains covered with forests through which there are few roads open to the public.

This was the case in New York State during 1938, after careful planning in bygone years to work out a program for the protection of forests. "We pay taxes," many people argued. "We want greater use of our forests. Let us change the laws so that we can hunt for game in more parts of the state. We want more camping sites, more roads too."

More hunters, more camping sites, more roads, of course, increase dangers from fire. Fires are costly to the state—to the people. They may not always destroy old trees, but they burn out the young trees and often kill the seeds and soil organisms in the ground. Then no new trees spring up to take the place of the old ones. The area must be reforested by planting seedlings.

Though today fires spread less rapidly than they used to, they nevertheless cost our government millions of dollars each year. Planes patrol our public forests, and many privately owned wood-

lands in thirty-eight states. Also there are more high lookout towers on mountains from which rangers may see fires. In both cases messages are sent by radio to stations from which help can be obtained.

THE DEMON FIRE

In spite of improved forest service, enough privately owned woodland burns off each year to cover almost the whole state of Alabama. Most of these acres are on land unprotected by the government.

"One tree can make a million matches, but one match can burn a million trees" is a popular saying among those who know the havoc a single spark can play. A cigarette carelessly thrown from a summer tourist's automobile smolders. It breaks into a tiny flame. The fire creeps into the dry leaf bed, shoots up toward near-by bushes. A little breeze, and the red demon is on its way to destruction of a forest and perhaps camps and villages. When fire starts on land that is unpatrolled there is, naturally, much greater danger than if it starts where scouts in airplanes are constantly patrolling.

In 1938 the worst fires in the history of Southern California blazed their way through canyons

in the mountains near Los Angeles. Movie actors joined with city firemen and CCC boys to check the flames. In Topango Canyon a motion picture was being filmed. As the fire crept along the mountain nearby the players stopped work and left their set to the flames.

The fire raged so fiercely that it jumped firebreaks. (A firebreak is a twenty-foot path cut through the woods to check advancing fire.) In one place forty fire fighters were trapped. Half of them jumped into automobiles and escaped. The others crept under a large fire truck and there they stayed until the fire had passed.

Herds of deer were driven from the mountains. They plunged down into the canyons and raced toward the sea, hot flames close behind them. Many dashed into the ocean. Others reached cliffs and dived off to their death. Cattle, too, were caught, along with small wild animals and terror-stricken men, women, and children.

A caretaker admitted he had started one of the fires accidentally when he dumped hot ashes into dry grass. He was arrested. A truck driver also was arrested. He started one of the fires with a cigarette he had been smoking in an area where smoking was forbidden by law. In this already

dry part of the state, watersheds and wildlife suffered badly as a result of these fires.

During the same summer lightning started hundreds of fires in west coast forests. In California 250 such fires were started; in Washington, 100; in Oregon, 73; and still others in Idaho and Canada.

In dry summer months fires may start even where people are careful. In August, 1933, loggers were working along Wilson River in Oregon. A steel cable ground against a stump. Heat from the friction started a fire. Loggers nearby attacked the fire but the flames jumped away from them, blazing through the cutover, dry forest floor. The next day six hundred men were fighting it!

Then came high east winds. The fire reached one of the finest stands of virgin timber in Oregon and made its way to the coast. For eleven days the conflagration swept on. The total loss in terms of money was \$350,000,000. This amount equaled the value of all the timber cut in our whole country during 1932!

FIRE! ROARING INFERNO!

It was early in the morning of a hot August day, not many years ago. The air of the forest in

northern Montana and Idaho was filled with smoke. Two forest rangers were galloping along a firebreak. "We must get out of this section right away," remarked one. "Within an hour these parched pine woods will explode from the heat. They are tinder-dry. No one can save them. We've had three thousand fire fighters here in this part of the state, but it's no use! We need rain; we don't get it!

"If only we could be sure that there'd be no more lightning! Lightning has been our worst enemy up here this dry summer. I don't know whether it started all the fires we've had, but there have been more than three thousand!"

"This wind is terrible," answered the other ranger as he rode hard against the gale. "It's growing worse every minute! We must get to the next fire tower as quickly as possible and telephone the fire fighters which way to turn next. But the wires may be down!"

As the two men galloped along, the roar of the wind increased. Their conversation was nearly drowned out by the groaning of the trees. Branches overhead lashed about. A large pine crashed near them. Another fell directly in their

path so that they had to take the risk of going into the woods to get around it.

When at last they reached the fire tower and began climbing up, the first ranger said: "We may be blown off this thing; but we'll have to risk it. We must try to see which way the fire is turning and warn the fire fighters and the towns in the valley."

When the men finally reached the top of the tower and looked out over the smoke-darkened valley, one ranger rushed to the telephone. He gave messages rapidly: "No use sending help here. Fire is jumping the river. Gale roaring now at fifty miles an hour. Pulling up giant trees. This tower may blow over any minute. Small fires that were nearly out are starting up again in the wind. Bob and I leaving at once to try to get out over the next ridge."



Several days later the two rangers were at breakfast in a camp with other rangers. They were exchanging stories about the great fire. "They say," one ranger related, "that two million acres of white pine were burned off in Idaho, and small

towns there wiped out clean by fire. Eighty-five people were killed."

"I met Pulaski," said another ranger, whose shirt was burned full of holes. "He told me he had been caught in a gulch with forty-five fire fighters."

Here is Pulaski's story:

"We found ourselves in a narrow valley shut in on all sides by flames—an inferno. There didn't seem to be a chance in the world of winning the race with the fire. We crept along through the smoke, stumbling over the dry underbrush.

"Then, as luck would have it, I came upon an old mine tunnel in the side of the mountain. We dashed in, though I was almost sure all of us would smother if smoke and heat should fill that narrow passage. But I didn't mention this to anyone! I knew we had even less chance of escape if we *didn't* try the tunnel.

"There was water in the mine, so I took a couple of camp blankets belonging to one of the fellows and soaked them. We hung these over the opening to keep out the smoke and heat.

"My men and I didn't get into that passage any too soon. The fire was close on our heels. It tore through the valley, which was like tinder.

We listened breathlessly to its horrible roar and crackling. In a moment the furnace was upon us and the earth grew hot. Every one of us thought we'd be baked alive even if smoke didn't suffocate us.

"The fellows grew crazy from the terrific heat and started to dash out. But I took my gun. I blocked the entrance and said I'd shoot the first one who dared to stir from the tunnel.

"The men stayed, and I stood guard at the opening of the mine. But I collapsed from the suffocating heat. Another man took my place. He told me about it afterward. Some of the others revived me, but not a man left the tunnel.

"At last the red serpent had licked up the whole valley and moved on. We all crept out nearly dead from exhaustion. I had thought the mine would become our tomb, but it proved to be a safe though horrible harbor for two hours.

"Still coughing from the choking air in the valley, we finally made our way out over the hot, charred ground and back to camp."



"We're going to have still more airplane patrolling one of these days," the ranger added after he

had finished Pulaski's story. "Brave men like Pulaski can't cope with these huge fires without more help. With a better airplane patrol, fires will be seen before they get much of a start. Someone will be on the spot to put them out.

"Lightning causes a lot of fires up here, but even without lightning there are always dangers—campers and smokers. A camper will forget to put out a last spark of his fire, and the smoker will toss his burning cigarette end to the side of the road. A few dead leaves and some grass during the dry summer—a conflagration!

"This part of the country can't stand fires like this every year; not every ten years! A tree crop takes more than fifty years to ripen. Look at this blackened country! What's it good for? Here's a swath a hundred and twenty miles long burned right off the map. Charred bodies of deer, rabbits, and young wildlife make a horrible picture. Not a green stick of wood is left.

"But there's more trouble to come. The spring rains will wash down over these God-forsaken hills and fill the rivers with cinders and mud. Then good-bye fishing! Of course, no one will want to fish here. Farther along the valley where the streams run down through green forest country,

the waters will be dark with mud from this black desert! Young fish will die, and then we'll hear complaints from sportsmen! We can always count on them to help us in our campaign against forest fires and muddy rivers!"

X. One Thing Depends on Another

LIFE ON THE EARTH CHANGES SLOWLY

Most changes in nature are slow. It has to be so. We could not live in a world where people grew up overnight; where zero weather froze us one day and very hot weather baked us the next; where mountain streams sent all their water down to the sea in torrents in a month, and for the rest of the year left the land dry and barren. Nature has so arranged it that things work together in a co-operative way.

There is not room in this book to tell much about the gradual development of living things on the earth. But when we stop to look back over a period of years we can see changes clearly. If we look into the history of a few animals to see what their ancestors of the far past were like, we can understand better that Nature takes her time.

SOMETHING ABOUT ANCIENT ANIMALS— PEDIGREED AND OTHERWISE

Scorpions and cockroaches are animals of distinction! They have long pedigrees—they can

trace back their ancestors for more than 500,000,000 years! Today these unattractive creatures look almost the same as they did in the earliest days! They have changed little. Scientists know this, for they have examined the family trees of scorpions and cockroaches. These family trees can be found in rock records which we call fossils. Scientists have found, too, that some forms of sea life, such as clams and shrimps, are also much the same as they were when life first began on this planet.

What did man and such animals as dogs, tigers, and horses look like in those very early days during the beginnings of life on dry land? No one knows. No one has ever found out what kind of ancient creatures were the oldest ancestors of man; no one knows what the most ancient ancestors of dogs, cats, or other mammals were, though we know something about their forebears of a *few* million years ago.

In the warm muggy days before large animals roamed the earth, the land was crowded with strange plants and queer trees. Many of them looked very much like ferns. Fossils tell us that huge dragonflies of all kinds flew about, while snails, centipedes, scorpions, and cockroaches

crawled in the marshes. Lazy lizardlike animals lolled on the shores or hid in the mud.

Although scorpions and cockroaches have been able to live through millions of generations without changing their looks or habits a great deal, many other forms of life have grown to look very different.

Read the history of the horse. Rock records of the earliest one show it to have been a tiny four-footed animal hardly larger than a rabbit. It was running around in America not so long after the great lizards (the dinosaurs) died out about 50,000,000 years ago. This is a short time, you can see, compared with the scorpion's 500,000,000 year history!

Many fossil bones of the horse and man have been dug up in the Old World. These show that very primitive man was roaming about during the days when the ancient horse had grown to be much larger. Drawings of ponylike horses have been found in caves in Europe. They were made by primitive man after he had learned to use his hands well.

In America many fossil bones of horses have been discovered. We can tell from these that this animal lived on our western plains during the

periods of three glaciers and for a long time after the last glacier disappeared. Sabertooth, the tiger, was also prowling around in the tall grasses. He probably caught many a colt from among the herds of wild horses that raced across the prairies. The mammoth (the hairy elephant), too, made his home here at that time.

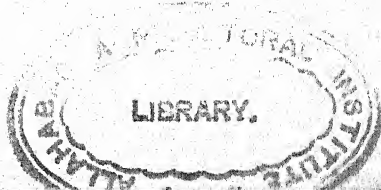
Yet when Columbus and later explorers came to our shores they found none of these animals. The Spaniards brought with them Arabian horses. Many of these soon began to run wild and once more horses were at home on our continent.

But what had become of the ancient American horses or some of their animal neighbors of those times? To this day no one knows.

ANIMALS AND PLANTS DEPEND ON EACH OTHER

All life, in order to carry on, must be able to take care of itself. Animals use their eyes, ears, and sense of smell to help protect themselves. Fur keeps out the cold; feet or wings make it possible to go from place to place in search of food or shelter.

Each animal has some special means of protection from enemies. A horse or a deer depends largely on its feet to carry it from an enemy. A



lion depends on claws and strong jaws; a hippopotamus, on its tough skin; a cuttlefish, on the dark cloud it sends out to conceal itself. A man relies on his wits, for he is not always a good runner or climber. He hasn't even fur to keep him warm!

Plants, too, have their own means of getting on in the world. Trees are protected particularly by their bark; skunk cabbages, by their bad smell; desert plants, by their tough skins and sharp thorns.

But, although every animal and plant has its particular ways of managing to survive, each depends on others of its own kind for help. Wolves in a pack can protect themselves better than single scattered wolves; a buffalo herd has a better chance of surviving than many single buffaloes scattered over the countryside.

Each kind of animal or plant must also depend on animals or plants of different kinds, for its very existence. The rabbit must have green plants for food; the fox relies on catching the rabbit and other small animals; the mountain lion may catch the young fox.

While all forms of life are of use to each other in some way, no living thing can survive without

water and the soil. The moon gets along very well without life upon it. The earth, too, could very likely go on without animal and plant life, but animals and plants would die without one another, without sun, water, and air. This has been so from the beginning of time. One thing depends on another, one thing helps another. This successful interchange is called the balance of nature. It is a law that must be understood just as we understand that water runs downhill and that fire burns.

A WELL-BALANCED EXCHANGE

In virgin country there is a well-balanced exchange of services among trees, plants, insects, birds, and other animal life. Nothing has been disturbed by man. The very soil has its own kind of balance. It depends on grass, plants, and trees to help make it rich so that life may go on. But the grass, plant and tree roots, and dead leaves, in turn, depend on the tiny bacteria, worms, and insects in the soil. And to make the circle complete, the bacteria, worms, and insects, in their turn, cannot live without the plant food.

Any one kind of insect, bird, animal, tree, or plant seldom increases too fast in a country un-

spoiled by man; it can't, for each acts as a check on some other. Such a check is called a "control," a natural brake that stops any plant or animal from overrunning the place.

Many insects live on plants and trees. The controls for insects are often small animals—the skunk, the mole, the mink. But as a rule birds are the most active controls. Birds police the woods and countryside. They protect trees and plants from tree moths, cutworms, lice, or other enemies. The flicker eats thousands of chinch bugs; the nighthawk feasts on grasshoppers, the chickadee on tree lice.

But the birds, too, have many controls. These are frequently larger birds—hawks, owls—which catch and eat them as a change from their usual diet of mice! Sometimes the controls for birds are four-footed animals—the wildcat, the fox.

Birds seldom increase to numbers that spoil the balance of nature. But there are times when they may do this. In 1851 a well-meaning person brought the English sparrow to our country. He thought the foreign birds would help to rid us of our weed seeds. But today these sparrows are a pest. Their numbers have increased very fast; they do little to control our weeds, and they drive

out our native birds that do so much to protect the trees from insects.

So far there has appeared no natural control to keep down the sparrows' numbers, unless it turns out to be the starling brought over from England by the same man who brought in some English sparrows. Since the starling's arrival the sparrow has quieted down somewhat.

However, the starling threatens to become a still greater nuisance, gathering in noisy flocks and driving out other birds. We hope a control will appear soon, and that the control will not become a pest in turn!

Large animals, too, play an important part in the balance of nature. Deer live in the woods. They eat grass, small trees, and twigs, and keep too many trees from crowding together in the forest. But too many deer would kill the forest, for not enough new shoots would be left. In a balanced country there are wolves and wildcats or one of their cousins, perhaps the lion. These catch the young deer or other grazing animals such as wild sheep. They keep the herds at a size where there are just enough animals so that the forest or countryside will not be injured.

Controls there are for all living things. They may sometimes be thought of as the enemies of the life they control—the badger and the marten are the controls (enemies) of mice and small squirrels.

A control may become “epidemic” and the animal be exterminated. You remember, the horse became extinct in our country. It may have been that the saber-toothed tiger increased so greatly in number that the horse was driven out.

The saber-toothed tiger itself, however, was exterminated! This fierce animal is as extinct as the American horse was during the time the Indians lived here. The controls for the tiger and the horse must have become epidemic. Perhaps they were some kinds of diseases; or perhaps the tsetse fly put an end to them as well as to a number of other animals of that time. The tsetse fly is not found in America today, but lives in Africa. There it has attacked and killed many cattle. Fossils of this fly have been found in our country. But while some scientists suspect the tsetse fly of having exterminated a number of American animals that were living here only a few thousand years ago, they cannot be sure of this.

Weather, too, has much to do with animal life and its habits. Every animal must be able to get along in the climate of the country in which it lives. Dinosaurs are supposed to have become extinct because marshes and seas where they made their homes dried up, and because the earth grew too cold for them.

Storms often kill animals. In England in a recent hurricane, a flock of sheep was blown over a bluff and into the sea.

Migrating birds are sometimes caught in storms. Numbers of them may be beaten to the ground or dashed against cliffs and killed.

GEESE THAT WERE GEESSE!

There are times when animals become confused and may not read nature's signs aright. Something of this kind happens each autumn at Niagara Falls when birds migrate south from Canada into the United States. Many geese and ducks lose their lives by being carried over the falls which they do not know are dangerous.

In October, 1935, we read in the papers that thousands of waterfowl seemed to be staying longer than usual at the falls. Perhaps they took their time because there was a fog, for birds some-

times change their flight if the weather is unfavorable.

Friends of wildlife watched the big birds alight on the Niagara River. They saw the stream hurry them along toward the noisy falls. As soon as the geese found themselves at this point, they rose into the air. But they did not know enough to go somewhere else! They returned to the river above the falls and once more were carried down toward danger.

This went on for twenty-four hours! Bird lovers who had been watching for hours grew tired and wished the flocks would leave. They were sure that many of the geese would become so exhausted by their fruitless attempts to rest that they would, in the end, be swept over the falls to their death. At last the men fired shotguns and turned searchlights on the river to frighten the birds. But for a long time they paid no attention. Finally, however, most of them left; only a few were killed by being carried over the falls.

This is an unusual case. What is the control here—the birds' stupidity? Probably it is Niagara Falls itself. The great roaring may confuse the birds since they do not seem to be frightened by either popping guns or flashlights.

MAN HAS BEEN STEPPING IN AND
SPEEDING UP CHANGE

We have been talking about the balance of nature and the time it takes to build a living world. What happens when man steps in and speeds up the wear and tear on land? What happens if fire and flood slow down nature's work of building soil? Life becomes more and more unsafe and costly as man lays waste his natural resources—soil, grasslands, forests, wildlife—without planning a way to restore them.

Nothing is said in this book about the waste of our minerals, for man can exist on the earth without them. Our primitive ancestors had been making their way for millions of years before they discovered how to use iron and copper. They managed quite well without buildings and machines of steel and other metals. They did not need coal for fires or diamonds and gold for trinkets.

But at no time in history has man been able to get along without water and food. Forest and grassland and all the life in them are the natural wealth on which he depends for his very existence. Whatever injures them injures him.

In America we have for three hundred years

thought of our natural resources as endless. They have truly seemed so. Today we realize that there are just so many square miles of farm and forest in our country and that all our fertile land is occupied. It is hard for us to believe there will never be any more land, good or poor, than we now have. The topsoil, trees, streams, grass—each has an important part to play. All must do their work as nature intended or some forms of life will suffer. Like a machine, when parts are removed, the work goes less smoothly. But as more and more parts are removed, the machine will at last come to a stop or will be wrecked.

During the days before the white man arrived, about a million Indians lived in our country. Today there are 130,000,000 people in the United States. Where many people live close together there is bound to be a difference in what they may do with their land, since what each does affects his neighbors as well as people farther away. Dust from one careless man's huge farm may choke his neighbor's well-cared-for farm and give his children pneumonia.

We saw how the people of New England found red prairie dust in their homes. Dust from those same acres fell on people in every state east of the

Dust Bowl—tons of it! Other tons were washed by streams at floodtimes into midwestern rivers, where they collected behind dams and stayed until dredged at great expense.

A CLOSER LOOK AT THE UPSET BALANCE

How can the upset balance that man has brought about be restored? Would we want to change the land back to what it was two hundred years ago, even if we could? Hardly. We would not like to make our homes in a primitive forest even if this were possible.

Our 130,000,000 people cannot live in the same way the 1,000,000 Indians used to live. Yet much can be done to restore our watersheds—our mountains, valleys, and plains—to a state satisfactory to us today, perhaps more satisfactory than primitive conditions at their best.

Before people are willing to change their ways of living they want to be shown just what is wrong with their country. Once they really see where the troubles are they will be ready to work out a way of saving natural resources. They will want to help restore those that have been lost, if this is possible.

The upset balance shows perhaps best in large

parts of the Middle West. The great number of acres of grassland plowed under or grazed over increased such pests as grasshoppers. A vivid example of what happens when the cover of the ground is allowed to be too severely grazed off by animals was noticed in the Wichita National Forest, in Kansas. Cattle grazed off land up to a fence. Beyond the fence natural ground cover—bushes, small trees, and grass—was left. It was found that grasshoppers infested the land on that side of the fence which had been overgrazed. The land on the other side had no grasshopper trouble! A two-strand barbed-wire fence could keep out cattle, but it could hardly have held back insects!

What caused the difference here? It cannot have been a matter of more food alone, since the pests could have found plenty of green things by hopping over into the woods. The acres of warm and rather dry soil made the difference. Here grasshopper eggs could hatch out and the young thrive in the hot sun.

XI. Pests and Epidemics

EPIDEMICS

What is a pest? A pest may be any living thing that becomes a nuisance and overruns the land. We have all heard of grasshopper pests; mosquito, ant, rat, and even squirrel pests.

When the numbers of a pest increase so greatly that they injure the well-being of other important forms of life, we sometimes call this an epidemic.

Here are some strange stories of epidemics which were brought about by man when he upset the balance of nature. In some of these cases natural controls appeared; in others, man is seen still struggling with the pests.

AN UNWELCOME INVADER FROM AFRICA

A dangerous newcomer appeared in Brazil during 1930. This was *Anopheles gambiae*, a mosquito from Central Africa. It entered Brazil as a stowaway but no one knows whether it arrived by airplane or by ship.

This newcomer is the most dangerous of all mosquitoes, for it carries the worst kind of malaria

germs. In one Brazilian county it gave malaria to nine out of every ten people, and out of every ten people one died of the disease.

Though the anopheles has been in South America only a few years it has spread to many parts of Brazil. Now people fear the mosquito will spread farther north and into Central America where there are warm damp valleys. The pest may even invade North America.

Meantime, scientists from Africa have sent word to South American scientists about the habits of this mosquito. In this way Brazilians can be helped to find a way to control it.

The South American scientists hope that the newcomer will find the climate on this side of the Atlantic not to its liking and will at last die out. Or perhaps an enemy will appear, some insect not harmful to man, which will drive out the *Anopheles gambiae*. If such an enemy is found, the scientists of Central Africa will undoubtedly ask to have some of the controls sent to Africa post-haste!

TOO MANY MUSKRATS

England is one of the old countries of the world. Plants and animals have become fairly stable

there; that is, new animals or plants brought in from other countries do not increase fast enough to upset the balance. Yet in 1917 one of our animals, the muskrat, threatened to overrun England.

"We buy millions of muskrat furs from the United States each year," said Englishmen who were interested in having enough muskrat furs during the war when trade was upset. "We have no native muskrats. Why don't we bring some over from America and raise them on our own soil?"

No sooner said than done. Live muskrats were brought into England. But some escaped and ran wild. There was no question at all about their liking the new country—the animals were at home from the beginning! They found excellent food in the small, carefully tended English gardens; they even investigated the sportsmen's trout and dined on fish! In other words, they "took possession."

But we read in the New York *Herald Tribune* during 1938 that the English had found a way of getting rid of these pests. However, the article did not say how this was done. Perhaps something

more about the muskrat in England will appear in the news someday.

MILLIONS OF RABBITS

In June, 1936, we learned that the Australians were still grappling with the rabbit pest! A number of years ago a man who thought he could make a good living raising rabbits for fur brought in a number of these animals. He was successful in his business but the rabbits were even more successful—they established themselves in Australia and soon overran the country.

Ever since, scientists, farmers, townspeople have all been working together to find a way to control or get rid of the rabbits. But so far the rabbits have got the better of them.

Central Australia is very dry. In parts the climate is something like that of our very dry prairies east of the Rockies. A great desert which reaches to the sea covers a large part of the continent. There are no natural controls for rabbits as there are in America—there are no wolves or foxes; no animals of the cat family, such as tigers or mountain lions. The rabbits eat the young seedlings of the mulga bush which grows on the

dry Australian plains. Then when the large bushes die or are eaten by sheep, no new ones grow up to take their place. The dry sandy ground begins to blow. Farmers find that it is useless to sow seed in order that new plants may hold down the soil. When the seedlings come up rabbits make short work of them.

Australia today has terrible dust storms that darken the skies far out to sea. Rabbits have had much to do with this.

Meantime ranchers complain that they cannot find enough good grazing land for their sheep and cattle. They lose \$500,000,000 each year in their business. What is more, the government spends \$5,000,000 every year trying to keep down the huge numbers of rabbits that eat up the farmers' profits. Even though many die during the long dry season, the few that are left start the trouble all over again.

And as for the fur business—it brings in \$5,000,000 a year. Rabbit meat, too, sells well. But when the loss of good grazing lands and topsoil is considered, the rabbit fur business seems to have been a dangerous investment for Australia.

CACTI MARCH IN AND MARCH OUT

Australia is a land of strange animals and plants. We know by studying the history of the earth that this great island was cut off from the other continents millions of years ago. Before that happened, strange animals very much like those found there today used to live on all the continents.

But when the land between Asia and Australia sank into the sea, the great island was left to itself. The animals living there remained much the same century after century, while those elsewhere, because they had so much land to explore and a better climate, slowly changed. They moved from one continent to another. They could do this because Asia and North America were once joined where Bering Strait now is. The land bridge which joined Alaska to Asia probably disappeared only a few thousand years ago.

Now we can understand why the native plants and animals of Australia, left to themselves for millions of years, are so different from others. They are not even like those of Asia, the nearest neighbor. The tiger, the elephant, the wolf, the horse, and certain other animals have all at one

time or another been at home on every continent except Australia. On the other hand, the kangaroo, the wombat, and the duckbill are found only in Australia. Saltbush and many varieties of eucalyptus trees are natives of Australia, but they are not native to other continents; while oaks, maples, elms, and others of our trees are not at home in the great faraway island.

About fifty years ago, a man took some North and South American cactus plants from our desert lands to Australia. "It is strange," he said, "that there are no cacti in a country that has so little rain. I'm sure these plants will do well in my Australian garden."

The cacti throve! They liked the country so well that they escaped from the garden and ran wild in the dry fields. They had just as good a time as the rabbits! These two invaders, the rabbits and the cacti, found no competition—no foes that ate them, no plants that crowded them out, no pests that preyed on them. By 1925, sixty million acres, fields that would almost cover our state of Oregon, became a jungle of thorny cacti. The natural bushes and grasses disappeared.

Australian farmers complained: "Our cattle and sheep cannot graze on cacti. The thorny pests

are driving out the native grass and saltbush our animals feed on. Something will have to be done! These animals are our living—if they are crowded out, we'll have to follow."

The Australians were discouraged. They were on the point of giving up in despair when a scientist came to their rescue. He became greatly interested in finding a control for this pest. He knew that in America certain moths live on cacti. If he could find one that would eat the plants fast enough, the cactus problem would be solved.

After long experimentation the scientist found one in Argentina. Some of these moths were set free in the Australian cactus fields. As they flew about, a dozen or more eggs were laid on every cactus leaf. Each single plant was well provided with eggs—and later worms! These tiny worms ate faster than the cacti could grow.

Today native plants which were driven out by the cacti are moving in once more. And as quickly as native grasses return to the fields, cattle and sheep are again brought back.

The retreat of the cacti goes on. Someday the thorny invaders may be wiped out, for in two years they have already been driven from one-fourth of their stolen territory!

STARVING ANIMALS

Not long ago the warden of Yellowstone Park complained that the range for elk was overgrazed. He sent word to Washington that the elk had increased at the rate of about two thousand head a year. He now had a herd of about twelve thousand.

"They have eaten off the hill coverings," the warden reported. "In most places, instead of grass and shrubs, only dead stalks and bare spots are left. Aspens are dying. Elks have torn away their bark, thus killing the trees. New young aspens cannot even get a start. The elk crop off the green shoots as soon as they put their heads above the ground.

"Even the branches of the juniper, which elk don't often touch, are torn off, leaving the trunks bare below. Only the tops of the trees are left. They look like pompons stuck on the bare pasture land. In some places the ground, once covered with sod, is stony—bare. Rains have washed off the topsoil. In other spots there is a network of small hillside trails made by the feet of the hungry elk. They go back and forth over the ground

in search of any green blade of grass that they may have missed before.

"Something must be done right away. The number of the herd must be reduced or the animals must be given a greater range for grazing. It isn't humane to allow them to be so undernourished. Their fur is poor, their bodies gaunt. They will become the prey to disease if this goes on.

"Meantime small animals that make their homes in the bushes among the trees, are driven from the park. Quails, squirrels, beavers, rabbits, cannot live on these grazed-over hillsides and valleys.

"The government has just added seven thousand acres to the park, but these added acres are already overgrazed by cattle. Ranchers have used them for years. It will take three or four more to restore them to good grazing country. Such worn-out land needs rest. No grazing animals should be allowed there for some time to come."

It is not known at the time this book is being written, what has been done to help with this elk epidemic. But since the government is constantly working on problems of this kind, it may be that man has been called on to be the control for the

elk. If hunters reduced the size of the herd each year, the range would gradually recover and the elk would be larger and healthier.

SACKS OF LOCUSTS

In China the balance of nature has been so badly upset in the past by cutting down forests and planting so much grain that pests often appear. In 1936 the newspapers told of a magistrate who wished to obtain help for the locust-infested farms of his district. Crops were being eaten off, locusts devoured everything in their path. Relief funds had been promised but did not come. The magistrate called in some farmers and said to them: "Go among your friends; ask as many as you can to fill sacks with locusts. Bring the sacks here and we will take them to the governor's office at the capital."

The farmers did as they were told. They brought back three thousand sacks filled with locusts. These were taken to the governor's office and stacked up in the hall. A farmer cut one open. Thousands of locusts swarmed out and buzzed through the halls of the building. There was no need to open any more sacks! The governor was

convinced that these people needed help badly and gave the magistrate the money asked for.

MIDWESTERNERS MAKE WAR ON GRASSHOPPERS

During the summer of 1938, New Mexico, Oklahoma, Texas, and Kansas had the worst grasshopper plague in the history of our country. Besides these four states, twenty others were affected. It is a long and dramatic story that can't be told fully here; but a few facts will show what the farmers were up against.

Two men were in charge of handling the pest problem for the troubled states. One was the operator of a huge ranch in New Mexico, the other was an operator of Texas ranches. On the advice of the government they decided to spread over the fields and ranges a poison mash made for the most part of wheat bran, sodium arsenate, and water or molasses.

The counties used their highway department trucks and those of the federal government to haul the mash from the eighteen mixing stations. These mixing stations were run by WPA men. Others helping were men from the National Guard, Soil Conservation Service, CCC, and the Department of Agriculture. Of course, farmers and ranchers

in the infested farmlands and cattle ranges were on the spot day and night.

Together the two operators in charge had more than 2,600 men fighting the grasshopper war! It was a war that the farmers felt none too sure they could win, even with federal and state help. In New Mexico and Texas alone the grasshoppers did \$5,000,000 worth of damage on ranges in three months and three times that amount by the end of the season. The war on these pests cost the highway officials of New Mexico \$1,000 a day!

The two men were well aware that once a range had been ruined by grasshoppers it would take that range three years to recover! This made speed important, especially since the grasshoppers were the kind that migrate. One female grasshopper can lay 250 eggs in a season! The war, then, was not one against an enemy appearing during the summer of 1938 alone. It would have to be waged in following years and would spread, even as it had been spreading in past years, unless something was done.

If you watch the newspapers you may hear more about this yearly war on pests. Perhaps when our birds find their woodlands, lakes, and

streams restored, their numbers will increase once more. Then they will be able to help the farmer fight his battles against insects.

BIRDS TO THE RESCUE

Birds often come to the rescue of man. The first pioneers who settled in Utah found this out. They had tilled the soil and planted grain. Their crops grew well and at last were ready to reap.

But as the farmers went out to cut the wheat, swarms of crickets appeared. These wingless insects came crawling and hopping over the mountains. They settled on the green crops and began devouring them. A whole day they feasted. Not content with fields, they entered homes and ate the food set out on tables. They even chewed up the straw hats men were wearing to keep off the burning sun!

Near the close of the second day the farmers saw clouds appearing over the horizon. The clouds were not rain clouds; nor were they other pests as the worried pioneers feared at first. They were clouds of gulls! In some mysterious way word had been brought to the gulls who lived at the northern end of Great Salt Lake that crickets were plentiful in the new farmlands of

Utah. It did not take them long to reach the scene and put an end to the pest.

Gulls and their smaller cousins, the terns, are usually seen along our oceans. However, some kinds live near our inland lakes and in the Mississippi Valley. They are the farmers' friends. These birds eat many insects. They fly about over plowed fields or where the grass is stirred up by animals. The black tern is especially fond of a meal of grasshoppers. He and the meadow lark are first-rate grasshopper and cricket catchers!

XII. The Pothunter—Friend of No Man

SPORTSMEN VS. POTHUNTERS

Hunters still kill many of our terns, our meadow larks (which they mistake for quail), and other birds. A thrifty farmer may wish to protect game on his property, but again, as with dust, he often suffers because he has a careless neighbor.

A farmer sometimes allows hunters to shoot game on his land. Each hunter pays a fee for this. The money helps the owner to pay his bills, but the hunters may destroy too much wildlife. A shortsighted owner does not realize how much birds, skunks, moles, and other small animals have to do with controlling insects. He may receive \$100 in fees during a season, but he probably pays out more than that for insecticides which he himself or his helpers must spread around. Birds and small animals would do a more finished job and cost nothing in cash, labor, or trouble.

Meantime the thrifty farmer living next to the careless one must also spend more for insect-

destroying sprays, since there is not enough game to protect his property. Birds and other wildlife, of course, pay no attention to boundary lines. They may fly from their nesting places, on the thrifty man's acres, across the careless owner's land and there be shot.

As to hunters, many of them feel that shooting in the open country is their right even though the property belongs to private people or to the state. They still think our animal life is limitless—just as some still think our forests are endless. Such hunters plunder the forests and fields. They are not sportsmen, they are pothunters.

There is a great difference between a pothunter and a sportsman. The sportsman knows something of the meaning of the outdoor world. He follows the rules of the game—he understands and obeys hunting laws. He has a license, he kills only the number of birds or animals the law allows, he can tell a meadow lark from a quail, he respects property rights, he can shoot straight, and he not only believes in but he helps to make laws that protect wildlife. The sportsman is among those who know best that, if our animals, birds, and fish are not protected, the day will come when there will be no more game to hunt.

The pothunter is the enemy of all living things. He is a highway robber. He and his kind feel no responsibility toward protecting the wealth of their country, and they do not seem to know that they are their own worst enemies. With net, trap, gun, and even dynamite they pursue wildlife. One hunter a number of years ago boasted that he had killed seven thousand canvasback ducks in a single season. Many another of his kind has killed thousands of small animals and game birds throughout the country.

Others, gun in hand, pursue animals breeding along our coasts. Great brown seals sunning themselves on islands called Seal Rocks in the waters near San Francisco are easy targets for hunters in boats. But lovers of wildlife have had something to say about the shooting of these seals. A few years ago when they found that the animals were missing from the Seal Rocks and were breeding only in out of the way places far from city life, these friends looked into the matter. Laws were passed forbidding the killing of seals. Within a short time the animals began to return; residents of San Francisco once more pointed them out to visitors from the East.

Left to do as they pleased, pothunters would

soon put an end to their own sport. They would wipe out all our native birds and animals, and that, of course, means man himself would die. For insects would step in right after the wildlife was gone. They would finish the evil work by eating up every green thing on this earth.

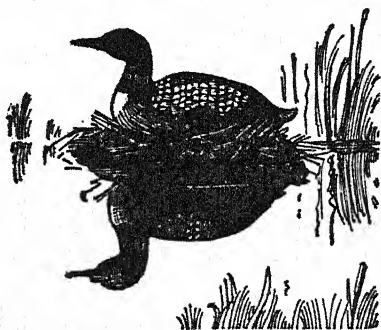
POTHUNTERS AND CIVILIZATION ALONG THE
FLYWAYS

Man and animals travel from one place to another. But no living thing travels regularly as far as birds do when they migrate with the seasons. It is known that in our country there are four great flyways. Along these trackless paths of the sky birds go north and south. Each kind knows its own flyway and follows it year after year, century after century. No one is sure why birds do this or how they find their way.

We read in an earlier part of the book about the geese and ducks that stop each year at the Niagara River as they travel north or south. This spot is on one of the four great American flyways. The one along the eastern coast is called the Atlantic flyway; the one west of it follows the Mississippi Valley and is called the Mississippi flyway;

still farther west is the Central and on the coast is the Pacific flyway.

Birds along the Central and Pacific flyways have suffered most from pothunters. The redhead and ringneck ducks have become scarce in many places. This is partly due to the fact that their nesting places, the marshes in Missouri and nearby states, have been drained.



When swamps are drained waterfowl disappear.

Some readers may ask if birds from the eastern or the Mississippi flyways could not find their way to the locust- or grasshopper-ridden parts of the Central flyway. The birds might then help the farmer wrestle with pests. But birds seldom leave their regular range. However, not long ago some horned larks strayed from their midwestern area and have been seen in New York State.

Though birds remain within their flyways year after year, some have a much wider range than others. The blackpoll warbler is found in the Atlantic, Mississippi Valley, and Central flyways, while the mourning warbler goes north through the Mississippi Valley only.

Besides the pothunters, wheat planters and road makers invaded the great Central flyway of small birds and large waterfowl. Water holes, swamps, small lakes in states where birds stopped in their travels or where they nested have been drained. Three-fourths of the one-time breeding places in the Middle West are now dried up. Though today many of these old lake or swamplands have been abandoned as unfit for crops, yet the marshes or ponds have not returned. The water table is too low.

In a few places the breeding sites have been restored by the federal government. Here birds may once more come and find protection. But until people get together and hunt down the source of the watershed trouble that is keeping the water table low, wildlife will not return to its old haunts. Perhaps some midwestern birds will become extinct. Then the danger is that

there will never be enough birds in that flyway to help the farmer control the growing number of pests even with the people's best efforts to protect the birds left in their part of the country.

XIII. A Search for Controls

MEANTIME?

Birds and small animals are our natural controls for such pests as grasshoppers and beetles. Since so many of them have been destroyed while at the same time our acres of grain have spread westward, what is to be done in the meantime—until wildlife is restored as far as possible? Government experts and other scientists are constantly experimenting. They are trying to find ways to control the pests until birds and animals have returned.

At one time the Navaho reservation at Shiprock, New Mexico, was visited by a pest of grasshoppers. The government sent funds to help get rid of them. With the money a thousand young turkeys were bought and set free on the reservation. These birds went to work on the grasshoppers and made a fine meal of them! Most of the crops were saved. The Indians, seeing what excellent food the grasshoppers made for the turkeys, even hoped they could perhaps keep enough

of the pests to feed the turkeys for the rest of the season!

In 1938 an article in the New York *Herald Tribune* suggested another way of lessening grasshopper trouble. A botanist from Seattle, Washington, advised trying the cobra plant. This plant looks something like a hooded cobra reared in striking position. Insects are attracted to it because the plant forms honey around its mouth. Scientists who have cut open plants have found in them grasshoppers, ants, beetles, flies, spiders, or even snails!

However, there may be difficulties in keeping this plant alive if it demands insects out of season! There will have to be more experimentation with the cobra plant before scientists are able to tell whether it can be of use to man.

XIV. Lost! Another Swamp

DESTRUCTION IN THE EVERGLADES

While experts in field laboratories are working day and night to find controls for farm and garden pests, enormous destruction of wildlife by man goes on! Newspapers today speak more openly about our troubles in keeping nature balanced than they did a few years ago. They are doing their part in keeping the public informed about affairs that affect their welfare.

We constantly read of unbalanced budgets in our news columns, but when man unbalances nature—that is news which the public still does not understand. Yet the unbalancing of nature is without doubt one thing that makes holes in our nation's pocketbook. Wasting our natural resources is closely related to unbalanced national budgets. Perhaps you will begin to understand this as you read the difficulties man brings upon himself because he seems to know so little about the earth on which he lives.

Our country is coming of age. We can no longer afford to squander our soil or wildlife. When you

think that 100,000,000 acres of our cropland are ruined you will feel that it is time for us to wake up, for this is as much land as there is in all New England, Pennsylvania, New York, New Jersey, and Maryland together. And this kind of waste is still going on.

The same mistake made by one state a number of years ago is being made by other states today. The Great Swamp along the Wisconsin River, we know, was one of the large natural bird sanctuaries of our country. It is in a key spot for the waterfowl of the Middle West and the river is, besides, one of the streams that feed the Mississippi. Uncle Sam has been restoring the old peat swamp with an eye not only to bringing back wildlife, but to controlling floods downstream.

Though millions were first wasted in Wisconsin by speculators, and then millions spent to restore the ruin, other states have been getting into the same trouble. News of the Wisconsin River swamp must have reached all parts of our country, since we have hundreds of newspapers and magazines and printed reports of what our government is doing. Yet, while this book was being written, articles appeared in our daily newspapers saying that Florida was making the same

mistake that Wisconsin had made. Florida, like Wisconsin, is a great natural bird refuge, but some unusual kinds of waterfowl nest there that are not found anywhere else in the United States.

It was known some years ago that draining the swamp was not practical for home building, but nothing was done about it. Perhaps "hard times" were partly to blame, perhaps not enough people saw what had been going on.

Florida, one of our most beautiful states, is a famous playland. It has beautiful beaches and marvelous natural wildlife. Thousands of people go there every year to enjoy the wonderful climate and to see the strange birds. The Everglades, covering millions of acres of swampland, have become world famous. Here among the tall sawgrass, or cypress and oak trees covered with hanging moss, live hundreds of thousands of birds of all kinds. Many of them are the long-legged, long-billed kind that visit ponds and marshes and find their food by wading around among the reeds. The swamps are alive with fowl that nest there each spring. Spoonbills, cranes, and egrets; gulls, ducks, and small birds, all live close together. Their cries fill the air as they rise from the marshes or circle about overhead.

In the jungles live alligators, raccoons, cougars, deer, bears, and other animals.

RUINED ACRES ABANDONED BY MAN AND ANIMAL

Yet without being able to see what would happen, "improvement" groups even before the Civil War advised draining these swamps. Some wanted canals dug so that yachtsmen as well as fishermen could cross in small boats from the Atlantic to the Gulf of Mexico. Others wanted to make money in real estate. Word went around that the soil was rich and it was a shame to allow thousands of acres south of Lake Okeechobee to remain useless swampland when they could be opened to homesteaders.

In 1850 Uncle Sam, urged on by senators of the state, gave Florida more than 20,000,000 acres of marshland for development. In exchange, the state was to dig canals to drain the vast swamps. However, nothing was done until 1881. At that time a private company was allowed to work out the canal idea, in return for which the company was to receive half the land. Millions were spent—sunk—in trying to draw off the water by canals. But the project failed!

In spite of this, speculators never gave up hope.

They kept right on casting longing eyes at the marshes. At last in 1906, after winning over the governor and gaining his support, another attack was made on the huge swamps and further millions of dollars were sunk in the project. More than \$18,000,000 had been spent up to 1929!

In 1928 there was a setback. A great storm visited Florida and wrecked much of the development. Once more Uncle Sam came to the aid of the state and gave still more millions to repair the damage and finish the draining. Four great canals, running southeast, and many smaller ones carried off the troublesome overflow waters from Lake Okeechobee directly to the Atlantic Ocean. "At last," thought the speculators, "after fifty years or so of hard work we have conquered the swamp!"

If turning the vast marshes teeming with wildlife into a semidesert can be called "conquering," these promoters succeeded. What happened after the "successful drainage" is a story of ruin brought about because of ignorance of watershed control. Speculators know nothing and care nothing about the balance of nature, the value of wildlife to man, or what happens to the water table when surface waters are drawn off. They do not study kinds

of soil to see what these are good for. Real estate promoters think that a half century of hard work is a long time in which to drain a marsh that would, they feel, be otherwise useless!

But scientists and lovers of wildlife know that it took nature thousands upon thousands of years to build these naturally balanced swamps which would take care of themselves—a paradise for millions of birds and for man, unequaled anywhere in its beauty and many forms of wildlife.

After 1929 at least 3,000,000 acres of land south of Lake Okeechobee were ready to be offered to buyers. Little by little the peaty soil became drier. Many acres were laid out in streets; sidewalks were put down. There was a land boom! Speculation in Florida real estate went ahead fast—for a short time. Investors bought hundreds of acres to resell, many of them to homeseekers who came all the way from Europe expecting to find land where they could plant orange groves! But only a small part of the whole scheme met with any success. Crops and orchards were a failure; homesteaders went elsewhere.

Today the pavements are still there, but they are cracked; grass and plants are struggling to hold their own in ground growing drier each year.

No longer can Indians travel by canoe through lake, stream, and swampy glades from Lake Okeechobee to the southern end of Florida as they used to travel during parts of the year. Small bodies of water are dry, larger ones shrunk, marshland lies cracked, baked hard in the sun. A few stray birds and animals seek out the wet mud holes that are left.

Visitors along the highway crossing the state south of Lake Okeechobee, look in vain for the thousands of birds that were one of the marvels of that part of the country. They see signs put up by the Audubon Society. The signs tell visitors that birds are protected by federal and state laws. But there is no danger of anyone molesting wildlife here—for there is little left to molest.

Instead of birds, visitors see smoke. Like the Wisconsin peat beds, the Florida dried-out mud burns easily. For many years hunters and Indians in search of alligators had set fire to the swamps, but their fires did little harm while the ground was damp; they soon died out. Now that the soil is drying up more and more each year, the fires are increasing. In 1939 they spread far and wide. Smoke darkened the skies at famous Florida resorts. Visitors who had come to see the birds were

greeted with a great pall of smoke. Guards kept automobiles off the main highway that crosses the state lest they lose their way and run into the canals. Animals and birds, which had lived here since before history began, fled or were killed. The peat made of dead roots, plants, and logs, which had been forming in the swamps for thousands of years, burned up in a few days or weeks!

The Florida fires and destruction of wildlife were one of our real tragedies. More than a million acres were burned over. Peat beds were burned down to bare rock; little soil was left. After the fire passed, the coral and limestone foundation lay bare and blackened. Here and there a column of smoke showed that a fire was still doing its deadly work where the rich mud filled deep cracks in the limestone.

Once more the United States government was asked to help. Real estate people and bird lovers worked together for the first time in the history of Florida. Members of the Audubon Society were for years about the only active friends of the Everglades wildlife who tried to stop the drainage plans. They made counts of birds to show how they were disappearing; they chased out feather hunters and robbers of birds' eggs. All this they

did for the love of the birds themselves, and not for any material profit to themselves.

Today these faithful guardians of our country no longer struggle alone against land speculators and pothunters. Real estate people in great numbers came over to their side, realizing that drainage meant loss of money to them. Uncle Sam is putting his hand into his pocket to help the state—this time not to drain it, but to fill in most of the canals and bring back the swamp!

Unless something is done in time to change the canal system so that enough water may always be saved to keep the marshes wet, the strange and beautiful wildlife in these swamps will be wiped out. A few rare birds have been threatened with extinction. The Everglades kite will probably soon be seen no more, for it lives on snails that crawl about in the marshes. When the swamp dried out the snails disappeared; and the birds which depended on them are now disappearing as well.

Alligators, too, are becoming scarce. No laws against killing them have been made though people are trying to put a law through. Hunters, taking advantage of the dry ground, can more easily catch alligators. The skin on the underside

of the animal's body is used for making leather for purses and shoes. Hunters get \$2.25 for a seven-foot skin.

We see, then, that the troubles of Florida since the drainage canals have been built are many: there is too little water—farmers and woodmen suffer, as well as wildlife. More hunters come in, birds are disappearing, other animals fleeing. Alligators are scarce; gar, fish that eat bass, are increasing! The alligator, people now find, eats the gar. Since Florida is noted for bass fishing in streams, this makes a new problem! What is more, in Uncle Sam's sanctuary near the southern end of Florida birds are threatened, for their feeding grounds are north of the sanctuary, in the part of the state that has been drained!

One bright spot in this picture of ruin is that there are places north of Lake Okeechobee and along the west shore where natural marshes remain. Here many birds and animals can still "carry on."

However, the rookeries left are overcrowded because of the "refugees" from the thousands of drained acres. One bad result of this overcrowding is that there are now too many raccoon refugees in the remaining swamps. In the spring of

1939 these hungry animals were found to have killed many helpless young birds.

So again we see that trouble in one spot means trouble for places farther away. Let us hope that the United States government, working with the Audubon Society and real estate people, will very soon be able to put back the water into the Everglades.

This seems all the more important since certain people in Washington and elsewhere want to have a shipping canal dug across Florida. Farmers, woodsmen, and game lovers, as well as scientists, say that a canal would probably cut across the underground water flow. It would let in salt water and ruin the land. They know that the state has a greatly lowered water table. A shipping canal that interfered with the flow of underground water would do still further damage to property already suffering from troubles brought on by thoughtless people.

XV. Uncivilized Civilization

INDUSTRY—ENEMY OF WILDLIFE

Copper and crude oil are two important sources of mineral wealth in our civilization. But both are deadly enemies of wildlife. Most of our copper mills and oil companies have not yet learned to follow rules for purifying their wastes so that water and air may be protected from pollution. Like the careless lumberman and the pot-hunter, many a factory owner thinks only of present profit. He doubtless believes that there is plenty of fresh air and water and that the spoiling of some of it near his place of business will not cause trouble.

That may have been true when there were only a few factories and plenty of unused land. But today the whole United States is becoming highly industrialized. Even the South, which for generations has been a land of plantations and woodlands, now has many fine factories and large industries. Its larger streams no longer run clear. In some places factories pollute the very air with fumes.

In the beautiful mountains of Tennessee lies a small town where copper is smelted. Homes, stores, a motion-picture theater, line the Main Street in the midst of a wasteland made by man. Sulphur fumes from the factories have killed trees, plants, and every blade of grass for miles around. Hills lie bare.

In such a desolate country the earth itself begins to move, for when grass and trees die there is nothing to hold the soil. The heavy rains of the South wash downhill, helped by gravity which is always at work. Gullies start, small at first, then growing larger as branching forks work their way back from the main gully. The river, once clear, becomes more and more clouded until at last it looks like a stream of heavy mud. The reservoirs of the very powerhouse fill up—with ruined topsoil.

How long can such a thing go on? Until the reservoirs fill, and power stops; until gullies grow so large, that they swallow up the buildings—the outlying cottages first, and at last the factory town itself.

OIL—ENEMY OF BIRDS

Wildfowl once were plentiful around our bays and the rivers entering them. But today most of

our sea birds have been driven away from harbors. Oil on the water has had much to do with this.

"Our terns, ducks, and other shore birds," the sportsman complains, "are having a hard time these days. Many of them are very helpful to man. Some of them are scavengers who clean up dead fish and garbage which is dumped from our boats at sea. At other times these birds dive for fish in the waters offshore.

"But in the last few years oil has been hard on bird life. Waterfowl used to be able to drop down to the sea and swim about in safety. Today the swim they take or the dip for fish will perhaps be the last one for them. Floating oil acts like a trap. It looks so much like water that the bird does not notice it.

"In some parts of California there are oil wells in the ocean. Patches of oil float around on the surface of the water and sometimes pelicans and other sea birds get caught in the greasy stuff. I have picked up such birds as they struggled on the shore. Their feathers are stuck together. They cannot rise from the ground. They try to clean out the sticky oil with their bills only to find that their

heads and bills become coated too. Birds whose feathers are matted down, die. They not only smother from the oil in their feathers, but they go hungry because they cannot move about to catch fish.

"Inland, in some parts of the Mississippi Valley, the story is much the same. Black sticky oil from hundreds of wells spreads out over many places. It gets into the streams. Geese, ducks, and swans, traveling north in summer or south in winter, must stop here and there to rest and find food along the way. Sometimes they get caught in the oil floating on rivers. A small spot of oil is often just as bad for a bird as a lot. Oil poisons the bird by working its way down through the feathers and no one can get it out.

"The worst of it is that oil wells are being drilled along the birds' natural flyways in the Mississippi Valley. New fields may open up in Iowa, Missouri, Nebraska, and Kansas. Perhaps the drillers will not find the oil they are looking for, but if they do, I hope that the states will see to it that the wildcat wells are carefully watched and that oil is not allowed to ruin the land."

OIL ON WATER—THE FISHERMAN COMPLAINS

"Fish," the fisherman complains, "are leaving our shores; oyster beds are being ruined—by oil from oil-burning boats, or from petroleum supply companies, or from oil refineries along rivers.

"Because oil is lighter than water it floats. Perhaps you think that this still leaves the water below safe for fish. But only people who do not understand fish would think that. Fish, like other animals, depend on oxygen for their existence. They find it near the surface of the water where it enters from the air. But there can be no free exchange of oxygen between air and water when oil coats the surface. Oxygen cannot go through oil. Some fish are suffocated; some are driven to other waters. Along the shore of Connecticut, where the water is covered with oil, large numbers of fish have been found—dead.

"What oil does to the tiny sea animals floating about in the water is just as bad. It kills these too. Since fish live on such tiny animals, the fish must starve unless they can get away to other waters.

"Then there are the oysters. They live at the bottom of the coast waters. Oil does not always reach them. Yet sometimes it does. Oily scum,

combined with other wastes from factories or harbors, may sink and reach the oysters. It coats their shells. The shell is an important part of an oyster. On it grow certain animal forms which the oyster needs for food. These animal forms die when oil coats them. Then the oyster dies too.

"Even if the old oyster could withstand the oil, the young one cannot. The baby shellfish is a larva, a kind of little animal that lives free near or at the surface of the water. It does not begin to form a shell until it is about three weeks old. Meantime the larva, like any fish, depends on oxygen in the water for its life. Its food, too, is found in the sea. If the surface is coated with oil, and oily substances are found below the surface, the larva dies, just as the fish does.

"Oil can be obtained from wells without ruining fishing or bird life. I read about some wells run by an American company in Bahrein, Arabia. When the Americans first began their drilling, the dark fluid which dripped into the water drove away the fish. Arabian fishermen complained loudly. They demanded justice. The Americans, wishing to keep peace, paid the fishermen for their losses; in addition, they piped their oil in such a way that not a drop of it entered the sea. So I

know that, if an American oil company can do a clean job in Arabia, other American companies can do a clean job in our own country."

OTHER LONGSHORE TROUBLES

The waters along the Atlantic coast are suffering from overfishing. Too many fishermen have caught too many fish for too many years! Besides, fish in rivers and bays along the coast are suffering from waters poisoned by city and factory wastes. The waters of the Hudson River, once rich in sea life, have become clouded and dark. Not long ago fishing around New York Bay was almost at a standstill. Bathing became unsafe. Complaints began to pour in from landowners along the rivers and from visitors to seaside resorts in New York and New Jersey. Residents and owners objected to valuable property and public bathing beaches being littered with lumps of tar, and with bottles, boxes, and orange peels, reminders that garbage was being dumped at sea.

Today garbage is burned in incinerators. Factories in cities of New York State and New Jersey are beginning to co-operate in purifying their wastes before they reach the rivers. In New York City sewage disposal plants are being built one

after another. Streams and bay are slowly beginning to clear up. Fishing for bass and shad along river fronts is growing popular once more; and greater numbers of wildfowl have recently been seen about the harbor.

The mayor and the park commissioner of New York City look forward to the time when the waters of the great metropolis will be clean. They will be so clean, it is hoped, that old beaches and new ones which the city has planned to lay out along the bay and rivers, will be safe for swimmers.

New England, too, is suffering from poor fishing. Whales? Few of these huge sea animals are found today along our New England coast. The whale-oil business has come and gone. And other kinds of fishing in New England are no longer as thriving as they used to be.

However, Nantucket fishermen have been awakened. Living on an island as they do, life has always depended on the sea. First the whales disappeared; then mackerel, cod, bluefish, and lobsters were threatened. Fishermen who make their livelihood out of sea food saw that for their own good something must be done. They got together and worked out a plan. They made rules about the number of fish to be caught and the places

where nets were to be put. They saw to it that young fish hauled in were returned to the sea and that spawning grounds were protected.

The plan worked. Fish and other sea life increased each year. In Nantucket fishing, crabbing, and lobstering will go on safely for the future as long as there is co-operation among the people.

The waters of the Pacific, off the coast of California, are today protected by the state. Shad flourish there, which (oddly enough) have been transplanted from the Atlantic Ocean! These fish have not been very plentiful in the East of late years, but transplanted to the West, where they were protected, they increased rapidly. So well do Atlantic shad flourish in the Pacific that today they are caught there, packed in ice, and sent to eastern markets!

Salmon fishing, also one of the great Pacific industries, is well protected by law. Uncle Sam knows that fish go each year from the ocean up the Columbia River to their spawning grounds. When he built a great dam to irrigate the land along the river and to create electric power, the salmon were by no means forgotten. A special water stairway was constructed for them so that they may pass the dam without trouble. Each step is a pool

of water. The fish jump up from one step to the next until they reach the top.

Many people thought these steps would not work. They said they had never heard of fish climbing stairs. But the scientists who planned the stairway thought the salmon would use them. And sure enough, they did!

WILDLIFE VS. POTHUNTERS

We have seen that year after year pothunters everywhere have been robbing the country of its wildlife. Though we may have laws to protect birds and animals, many Americans have not yet been educated to take pride in the beauty and wealth of our country. This is partly because we have thought of our land, our forests, birds, and animals as endless. Only slowly are we learning that our resources are not boundless, and that some are already at an end—gone from us forever. The conservation program needs friends—Americans who want to help protect our riches and use them wisely rather than plunder them.

Meantime what of our wildlife? Some of our birds and animals have disappeared from the continent. Others may soon follow unless enough friends come to their rescue.

Birds have probably suffered more from pothunters than animals. The great auk (the North American penguin) has disappeared from the earth. This bird bred in Labrador but went south to Florida for the winter. It is said that many of the birds were killed by hungry sailors and that others could no longer find safe nesting places.

The Carolina parakeet, a brightly colored bird that looked like a small parrot, also disappeared. In early days it was caught and served on the table as a great delicacy by Southerners.

The heath hen, a cousin of the prairie chicken, has not been seen since 1932. This bird looked much like a barnyard hen. It lived in swamps and marshes, but when these were drained by man it could no longer find nesting places and so gave up the struggle.

The California condor may soon become extinct. Only a few are left. This great bird is a harmless scavenger, but thoughtless people, who think that any large bird is dangerous, are slowly killing it off. Friends of animal life are doing their best to persuade the public to protect the condor. But the wild mountainous country of the West is hard to police, and pothunters are not easy to convince! They are more interested in showing

off their marksmanship than their sportsmanship!

Where are the great flocks of passenger pigeons that used to travel north and south during the spring and fall? They were killed off by pothunters! In the past these birds flew by the million, darkening our skies. Everyone thought them countless.

In 1828 John James Audubon, who probably knew more about American birds than any man of his day, said that there was no danger that the passenger pigeon would ever be exterminated unless our woodlands disappeared. But those who hunted these wild pigeons to sell in city markets killed such great numbers of them with gun and net that not one can be found today. The last one died in 1914.

Animals living in only one part of the country (such as the bighorn of the Rockies) are usually more easily exterminated by pothunters than those that range widely. Fortunately, there are still numbers of the bighorn among the mountain fastnesses.

The Badlands mountain sheep and the Texas mountain sheep have not fared so well as the bighorn. Both these kinds have been exterminated. The California grizzly, the Tejon grizzly, the

Texas grizzly, and the Plains grizzly have met the same fate.

The giant mink of Maine was killed off many years ago and the sea otter of the North Pacific coast is threatened with extinction. Many other animals may soon be wiped out, among them the Glacier bear, the Arizona grizzly bear, the Pacific and the Atlantic walrus, the Nelson mountain sheep, the Sierra mountain sheep, the Florida manatee, the wolverine, the monk and the hooded seal, and certain kinds of squirrels. The odds seem to be against these animals at present—they still have more enemies than friends among hunters.

Bison, once moving in great herds across the plains, were almost exterminated. About 60,000,000 of them lived in our country before the Civil War. Yet so many were killed by the pioneer hunters and those who came after them that in 1889 probably less than a thousand were left. There were only about forty in Yellowstone Park in 1900, but a few remained on private ranches. The government obtained some of these and to-day there are more than one thousand in Yellowstone Park alone. It is planned to allow the Black-foot Indians to care for them during each winter

and to permit some of the animals to be used for meat.

Elk, even though they were once at home in the East, Middle West, and Far West, had nearly disappeared at one time. Those left in their wild state have hidden themselves away in the Rockies in places where man seldom goes. A few years ago the government put a number of elk under the protection of Yellowstone Park. We read earlier in this book that these animals have increased so greatly in number that their range is much too small. However, something will be done soon to remedy this.

In the United States today the natural balance between animals and their field and woodland homes has been lost. This is largely because some of the native animals and certain growing things have been destroyed, while new ones strange to the country have been brought in. Soil and water changes also have had something to do with the upset balance. Yet a new kind of balance can be found, partly man-made, for our parks and natural country as soon as state and federal governments have had time to work out this problem. It will take many years and much study of the life habits of each plant and animal.

XVI. The Beaver, a Natural Conservationist

THE BEAVER GROWS POPULAR

There is a small animal that at one time was found almost everywhere in our country. That animal is the beaver. Beaver skins were so valuable in the days of the early traders that they were used as money. Indians and white trappers looked for the beaver near lakes or the headwaters of rivers. Here it cut down birches, alders, and small willows—enough for food and for making dams. The dams held back water so that all members of the beaver colony could have a cool place to swim in. Close to the dam the animals stored their food and built a home safe from their enemies, the bear and the wolverine.

The beaver is hardy, and was at one time so plentiful that no one thought its days might be numbered. Yet a few years ago many feared that this small animal would surely be exterminated just as the passenger pigeon was, by pothunters and trappers. It had been hunted out of all but

a few mountain fastnesses. But luckily public-spirited people saw in time what was happening. Since 1917 many states have passed laws protecting the beaver during most of the year, and sometimes all the year round.

Beavers today also live contented and useful lives in some of our large forest parks. Here during the winter and early spring they help to hold back floodwaters, and thus the ground remains moist through days of little rainfall.

In some states conservationists (people who wish to save our trees and animals and other natural resources from destruction) are "planting" beavers along many small forest streams that feed our rivers. Occasionally they receive complaints that beaver ponds are too warm to help in the breeding of fish in forest streams. However, these complaints are seldom just. During heavy storms, it is true, beaver ponds sometimes spread far beyond their limits. This water may grow warm, but seldom does it stay long among the trees. It sinks into the ground leaving only the main beaver pond, which is usually quite deep—six feet, more or less. Fish find many quiet spots along the banks of beaver ponds in which to lay their eggs.

Since these busy animals become friendly to man, many people are interested in bringing them back to our woods. Though as pets in parks they will probably never become as popular as squirrels, still they are growing to be great favorites in mountain reservations. They even get into the newspapers from time to time!

ANIMAL ENGINEERS DURING THE HURRICANE
OF 1938

"Upstate Beavers Hold Back Floods" we read in the papers in September, 1938. During the great hurricane that tore its way up the eastern part of our country, the superintendent of Bear Mountain Park, in New York State, found that the beaver colonies there had played a big part. These "engineers," the *New York Times* article said, had saved several highways in or near the park from becoming rivers and carrying with them precious topsoil from the forest floor.

No one can tell whether the beavers knew that a storm of unusual intensity was upon them, threatening to deluge their particular strongholds and perhaps even break their dams. (Beaver dams seldom break, though they may overflow.) Whether they knew it or not, the beavers in the

sixty colonies of the park were at work the very night of the storm! They cut down more trees. They dragged them to their dams. They dug up mud and filled in the openings. One of their dams, which is six hundred feet across and six feet high, and already very strong, they made still stronger.

So much rain fell that park lakes overflowed. Streams widened out. The very hillsides became stream beds, for their deep, loosely matted carpet of leaves and roots could not soak up the water fast enough. But much of the runoff, headed for the Hudson and the Ramapo did not reach these rivers that night. Some never reached them at all! It got as far as the beaver dams, filled the ponds, and then backed up and spread out into the valleys. It formed great shallow temporary lakes. Here the water lay among trees and underbrush and gradually, as the storm subsided, it sank into the ground. There it probably joined some underground storage reservoir and was ready to be drawn on during the dry summer months.

Because beavers build dams on small streams in the upper parts of large rivers they are very valuable as balancers of nature. They hold back

water—make it “walk,” not run, into rivers. Conservationists call them master balancers.

FAIR EXCHANGE

Another state that has been bringing back beavers to its forests is Illinois. In 1935 the United States Forest Service, working in the woodlands of that state, made a suggestion to the people. It ran something like this: “We have received word that Wisconsin would like to have wild turkeys in her forests. Now, we have many in our woodlands and can spare a few if we get something in exchange that will help our forests. Wisconsin, like us, can spare some of her wildlife. She can spare a few beavers if we can give her something that will help along her forests! Why not arrange for an exchange? We’ll send her a truckload of turkeys; she can send us back a truckload of beavers!”

This suggestion was accepted eagerly by both states and the exchange was made!

BEAVERS WORK FOR UNCLE SAM

In Colorado, along small streams that feed the Arkansas River, two hundred of these animal engineers are now at work building dams for us.

These dams will catch the topsoil that is washed down when there is a sudden heavy rainfall. If the ponds fill up too fast, the beavers will move downstream and begin again.



Beavers work for Uncle Sam.

The game warden is sure that within five years the animals will have floods well in hand in that part of the state.

The day will come, if Uncle Sam has his way, when beavers will work for him in every state of the Union. They will carry on much of the necessary engineering work along the small streams of our watersheds. They may take over so much flood

control work now being done by men that it will look as though beavers were taking jobs away from men!

However, these animals had charge of stream control through centuries, and did it well. We have to admit that millions of dollars can be saved and used for other important soil conservation work by letting the beavers again take over a good part of our river control program.

ODD NEIGHBORS

Beavers, though master balancers in a forest, may cause trouble for man if they set up house-keeping too near man's doorstep! Occasionally in recent years beavers have busily built dams on outlets of lakes surrounded by summer cottages. When the owners came to spend the holidays they found a strange sight—lakes were overflowing their banks and flooding the shores! Trees along the edge were dying, and flooded roads were badly damaged. If the law will allow beavers to be moved from such places to spots more favorable to their activities (and to man's), that is the answer to the problem.

But sometimes the beavers have the law almost entirely on their side! Not long ago we read in the

papers that a certain farmer in Canada found himself in a tight place. In the middle of the summer beavers moved into his acres. They chose the stream on his farm as a good place for their dam. Little by little the water began backing up. It backed into the farmer's crops, and still the water rose! He called the police. He wrote to the Canadian government. But nothing, they said, could be done until spring!

As the lake widened and widened, the farmer grew more and more frantic. But he was not allowed even to move the beavers to the spot above his farm where no one's property would be injured. "Wait until next spring," the officers cautioned him.

All the poor farmer could do was to pray that cold weather would soon come and freeze up the lake, and prevent its spreading toward his home.

The newspaper story did not explain why the beavers could not be moved until the spring.

XVII. Modern Pioneers

GREY OWL, AMERICA'S FRIEND

Many American Indians have a deep feeling for the conservation of our forests and wildlife. Leaders among them do all in their power to save what they can of their heritage which the white man took over. Among these leaders was Grey Owl, a Canadian Indian who died in 1938. He gave his life to his country, after having worked tirelessly for its protection from the wastefulness of thoughtless people. He especially understood the beaver and the important part this small animal plays in the woods.

Grey Owl was born in Texas. He had a Scotch father and an Apache mother. He did not go to school but learned something about geography, history, and English from an aunt. The rest of his education he obtained for himself in the woods and among people he met who were interested in the outdoor world.

When Grey Owl was quite young he toured the United States with Buffalo Bill, as a knife thrower. But much of his life he lived in Canada as a

trapper, yet always a protector of wildlife. He early saw the difference between the sportsman and the pothunter and he begged leading Canadians to use their forests and wildlife wisely.

The government saw how deeply Grey Owl felt about the waste that was sapping Canada's wealth. They put him in charge of an experimental beaver sanctuary in Prince Albert National Park. Here the Indian was so successful that other wildlife sanctuaries were opened and put under his care.

In order to plead his cause with the Americans, Grey Owl wrote articles about animals for the newspapers. He went about the country giving talks to those who loved the natural beauty of Canada as he did, and who wanted to rouse people to make a change in their careless ways. He took moving pictures of animals in their haunts. Later, at the invitation of King George VI and Queen Elizabeth, he went to England and showed two of these moving pictures and so won many more friends for his cause.

Grey Owl was only fifty years old when he died. Life had been sad for him because the white people's civilization seemed to mean destruction of forest, soil, and wildlife—the very things that

had made America's wealth possible. He spent his last ten years trying to point out to his fellow countrymen how they could save their natural gifts so that these might be enjoyed by their children and children's children through the years to come.

EPIDEMIC—OF HUNTERS AND PLOWMEN!

There has been an epidemic of plowmen in North America during the past one hundred years. The farmers, by turning up the soil and planting grain, made it easier for crickets and grasshoppers to thrive. In our vast grainfields these insects find plenty of food to their taste.

At the same time there has been an epidemic of hunters. They killed many of the birds that would have devoured the grasshoppers. With an epidemic of both plowmen and hunters, will insects perhaps get the upper hand of men on this earth? They may. They have lived here millions of years longer than man, longer than mammals or birds of any kind. They breed quickly and thrive in open fields wherever there is something green growing.

We know that birds and small animals are the controls for the insect world. But what are to be

the controls for the epidemic of hunters and farmers? Who but the hunters and farmers themselves? Many of them today are learning to see and understand what they are doing when they kill wildlife ruthlessly and plow land wastefully.



There was an epidemic of hunters.

There is hope for the future. We may someday be able to keep insects down to their rightful place in the world of living things.

A NEW KIND OF ARMY—CONSERVATIONISTS

Within the past ten years many more friends of wildlife and our other natural resources have

come to the front. They are our new army of defense, those who believe in conservation and a more civilized civilization. The number of these ardent defenders is growing daily—people young and old who love all the things Grey Owl stood for, but who love the wonderful things civilization has given them as well.

They feel that, though we need factories to produce things for our daily lives, there are ways of keeping our rivers clear so that fish will return to them. These conservationists know that, although lumber from forests is needed for homes and industry, forests must be cut and cared for in such a way as to preserve not only the trees but also the soil and wildlife in them. These are the very foundations of our country. If the natural balance among them has been disturbed, it must be restored or a new balance found.

The public is beginning to feel that gold boom, oil boom, wild West, free land, made zestful and colorful front-page news, but they were expensive—they brought about great waste—in resources, money, and human lives. The new trend is toward taking responsibility for defending our country not against outsiders, but against the pothunters and speculators among us. The army of conserva-

tionists is coming to the front more quietly than the boom-day hordes, but with determination and sturdiness that will outlast the zest of the fly-by-night speculators. For we know today that without conservation there can be no civilization.

In overcrowded parts of China, where homes are close together in the country, every inch of ground is guarded. No bit of topsoil is allowed to run away through man's carelessness. Soil means life or death to these struggling families. They must live on what they can raise in their own small gardens, for their government is too poor to give them help. A father with a growing family has been known to slip from his home during the night to steal soil by handfuls from a neighbor, so that he would have enough to grow the beans he needed for the many mouths to be fed.

Within the past few years wars have disturbed life in vast parts of the world. At the same time civilized people see more and more that, unless wars are stopped and we balance our controls one with the other, unless we guard our treasures, both natural and man-made, there can be no real progress.

Many strong hands are needed, hands of pioneers in thinking and rebuilding our country.

New frontiers are opening—frontiers in science and in the use of our knowledge and inventions to help balance our civilization. This science, the greatest of them all, is called social science. Whoever becomes a master of it becomes a builder of a nation, and one who wishes to see other nations grow in the same thrifty way. He does not want the kind of liberty that means freedom to starve and let others starve if they wish to waste their country's wealth. The new freedom is helpful. Men come together with their problems, talk them over, work out a program that will give both responsibility and happiness within the area of what there is for all to share.

PIONEERS IN THE CONSERVATION OF WILDLIFE
—THE AUDUBON SOCIETY

One of our first conservationists was John James Audubon, lover of wildlife. Born in 1785, he spent his life studying birds and pointing out their beauty, as well as their importance to our country. Yet at heart he was more of an artist than a campaigner. So deeply did he love our American birds that he spent most of his time drawing and painting beautiful pictures of them.

Audubon's whole life was a struggle. As a young

man he was very poor. His wife taught school to help with the family budget while he went on with his painting. A great catastrophe happened to them in the midst of their difficulties—rats got into Audubon's collection of drawings and paintings and ruined the work of several years.

Though this blow was most discouraging, the artist did not give up. He began his drawings all over again! Many of his original paintings can be seen today at the Historical Society in New York City.

Audubon died in 1851, but his memory is living. The National Association of Audubon Societies for the Protection of Wild Birds and Animals, founded in 1901, was named in his honor. It has members all over this country and Canada. More than 100,000 children become junior members each year, and more than 6,000,000 have been enrolled during the past thirty years. Members young and old have pledged themselves to take an interest in American wildlife and to protect it.

Audubon Society wardens guard many of our sanctuaries along the Atlantic Ocean and the Gulf of Mexico. There are several in the Florida swamp and lake country, and one at Great Salt Lake, Utah.

The sanctuary idea was first begun in our country in 1900 by private groups of bird lovers. They helped to form the Audubon Society. Uncle Sam did not become very active until 1916. During that year the first National Park was established. But because there is not enough money even today to police the parks and bird sanctuaries and protect them, the government depends very much on the private wardens of the Audubon Society.

The society has from the beginning been active. It kept right on in its protection of birds through the 1900's, troublesome times for lovers of wildlife, since few people understood their value in forests and on farms. In those days members were often accused of willfully trying to interfere with private business. Milliners, furriers, meat dealers, and hunters have all at one time or another complained loudly against the wardens for endangering their livelihood. Hunters, no doubt still thinking of our wildlife as boundless, killed birds and animals in enormous numbers not only in forest reserves (after these were created), but anywhere they could. Nothing was done by any of them for the protection of the wildlife from which they claimed a right to make a living.

While Theodore Roosevelt was President of the

United States he made himself very unpopular with those who were in the business of shooting small, brightly-colored birds of all kinds. These were sold for trimmings for women's hats. The President agreed openly with the Audubon Society that birds belong to all the people. He felt that they are a part of our American life and ought to be protected. At the rate they were being killed off, he foresaw that they might at last be destroyed entirely. If Roosevelt had not given his support to our early conservationists, egrets—large, graceful, white birds sought after for their beautiful feathers—and other kinds of birds would have been wiped out years ago. That is what happened to the passenger pigeon and the heath hen.

In the early days hunters were, of course, numerous. As soon as parks and reservations, both private and public, were created, there was naturally much anger among some people. Those who claimed as their own the woods and every living thing in them often made trouble. Wardens sent by the Audubon Society to guard reservations had a hard time of it. The first warden who went into the vast jungles of the Everglades in 1902 ran into a group of angry plume hunters. Though his

mind was made up to enforce the law, the plume hunters made short work of him. What chance had a lone warden in a country dense with plants and trees? For years the Seminole Indians had found these swamps an ideal place in which to hide from the white man.

A few years later another warden disappeared in the Everglades. Later his boat, weighted down with sandbags, was found sunk in the swamps, together with a bloodstained ax.

The road to an understanding of our natural resources has often been a rough one, yet much has been accomplished. Because of the courageous work of the Audubon Society, whose members roused the people to a realization of what was happening, we no longer see birds' wings or the birds themselves sold for hats. New York was the first state to pass a law against this kind of thing. That was in 1910, but since then other states have passed the same kind of law. The shooting of birds for their feathers has almost disappeared in North America.

Nor are birds killed to be sold in markets for food as they used to be. If pothunters tried to sell birds to milliners or to city markets today it is doubtful whether a single buyer could be found.

Dealers do not want to pay fines for breaking laws. Besides, shoppers would look doubtfully at hats trimmed with birds; and if they saw wild birds for sale in shops they might ask, "Isn't it against the law to shoot wildfowl for markets?"



Scouts help farmers to "post" their acres.

BOY SCOUTS OF AMERICA

The Boy Scouts of America are ardent conservationists. During the spring numbers of them can be seen out in the open woods burning off nests of tent caterpillars which they find on wild cherry and other trees.

Boy Scouts also help clear trails and put up

signs for the protection of game. In schools they appeal to groups of children to stop the robbing of nests or the pulling up of rare wildflowers and ferns for collections. They urge young people to hunt with a camera or to carry a sketchbook.

Scouts are among the first to join conservation clubs of all kinds, such as nature leagues and the Audubon Society. Those who live in rural sections encourage farmers to "post" their acres, that is, put up signs that hunters may not enter and kill game. They try to make it clear to farmers that they should befriend the birds and small animals since these protect their orchards and fields from pests.

During 1920 a Boy Scout in Indiana aroused the interest of so many farmers that he won hundreds of them to the cause of conservation of wildlife. Two hundred and sixty-six private wildlife sanctuaries were created in Indiana through this one boy's efforts.

4-H CLUBS

Everywhere in our open country we find 4-H Clubs. They are made up of young people who are interested not only in wildlife and its ways, but in whatever makes wildlife possible. There

are more than one million members in the United States today. These young people know that birds cannot live without trees any more than trees can live without birds. They know that animals cannot exist without other animals on whom they depend for food, or without plants which provide both food and shelter.

The 4-H club members are boys and girls who, like the Indian, love and appreciate forest, open field, and stream. They spend many hours among the trees and along brooks. Because of their love for wildlife they learn its language in a natural way. They know that if they wish to be a worthy part of the outdoor world they must give it their head, heart, hand, and a healthy body.

There are no set rules that all members must follow, but the goal is to do something to show pride in their country. The young people not only wish to protect its natural wealth, but many do what they can to improve and build it up.

Sometimes a club may make a special study of animals. One boy locates the haunt of the mole or the skunk; another draws a map showing haunts of wildlife on his father's farm; another writes the life story of a beaver or a mink; another finds

out all he can about how the small animals on his farm control pests.

Other clubs may study forestry. They appoint junior forest rangers some of whose duties are to report fires and help with the protection of wildlife.

Another group may carry on a cat campaign. Members try to interest people in birds and in pets that are not harmful to birds. They point out that probably every cat in suburb and farm kills several young birds each year, and that there are many cats which kill many birds.

Still another group may be especially interested in the work of the friends of wildlife throughout our country. They may do as much as they can to have people join a conservation club, such as the Audubon Society, the American Nature Association, the Izaak Walton League of America. They urge members of these groups to join the General Wildlife Federation which is made up of all the conservation societies in the United States. This huge federation had its first meeting in 1936 to see how bird lovers could best work together to protect our fast-disappearing wildlife.

The members in another community may map out a program to improve the woodlots and hedge-

rows of certain co-operating farmers. They make plans for a demonstration of what can be done through an intensive "campaign" to build up the value of property. They go over the acres first and calculate the number and kinds of wildlife living upon them. They show how improvements can be made. They estimate costs.

Then they set to work to "improve" the property from the point of view of wildlife. They know that improving from the point of view of man may mean cleaning up all the underbrush and hedgerows. But to wildlife, improving means something almost the opposite. It means leaving thickets, shrubs, and brush heaps! And if these have been cleared away they must be set in again.

The boys put up barbed-wire fences to keep cattle or sheep away from shelter spots for quail, pheasants, meadow larks, ground sparrows. They plant bushes and small trees which bear large seeds or berries—blackberry, chokecherry, elderberry, sumac, and others. These attract the birds and keep them away from the farmer's orchards and cornfields. They set in close-growing pines, further dense shelters for quail and pheasants. They provide protected spots near water—a pool or small stream.

The boys and girls in this undertaking keep track of the increase in wildlife. At the end of the experimental period of perhaps one or two years, they are ready for their demonstration. They invite farmers from near-by towns to come to see what has been done. They show the maps made at the beginning of the experiment, and the record of the number and kinds of wildlife at that time. Then they point out improvements they have made in the property, the cost, and the increase in the number of animals.

The young conservationists know that nothing will convince a person so well as to show him what you have done that he, too, can do to increase the value of his farm.

TOWN FORESTS

The West and the South are not the only places where farms have been abandoned. As you drive through the open country or the hilly woodlands of New York, Massachusetts, and other states in the East, you see run-down farms, abandoned, overgrown with wildflowers, second-growth trees, and shrubs. Often you hear a brook murmuring its way through the thickets.

These old homes look interesting and you wish

you could stop here and there, push your way through the tangle of bushes and brambles to explore the deserted buildings. Daily we hear about families looking for farms, a place to live, yet here are old farms that look as though they would make lovely homes. Why do not people live in them?

The soil, never very rich in some parts of the Northeast, is run-down, and some farmers do not know how to make good use of land. Just as many a mountain farmer in the South does not know how to raise anything but the one crop (corn or tobacco or cotton) that has ruined his land, so many New Englanders have not learned the way to make land pay.

Some years ago on the outskirts of Russell, Massachusetts, there were numbers of run-down farms. Many were deserted, but families were still living on a few of them. These people were so far from village schools that it cost a great deal to keep the roads open in order that children could get to their classes. The men of Russell and its outlying farms got together and arranged that these scattered families should be moved to good land near town. An exchange of property was

made and all the abandoned farms were turned into a town forest.

This forest began with about a hundred acres, but slowly increased in size until today it contains five thousand acres. Pines were planted where there were open fields.

The town forest keeps the people supplied with firewood and much of the timber for town use. Its value increases each year as the trees grow. Never are the woods cut over clean. Trees are cut when they are ripe or large enough for local use, or if they are in the way of more promising trees. By the time the children of Russell are grown there will be no taxes for them to pay. Instead, their town forest will be paying the town taxes; in addition, there will be a surplus with which the people may meet their bills.

In a woods of this kind there is work for many townspeople—there are roads and trails to look after; trees to be cut and new ones set out; shrubs to be set in whose berries will attract birds and at the same time hold the soil; and sometimes there is land to be graded.

In addition, forests of this kind, since they are often on the hilly uplands, are a protection for the watershed. They are a haven for wildlife and may

be used as a playground for nature lovers. As they grow in size, there may even be good fishing in the streams.

Forests are a protection from too much wind; they purify and cool the air during the summer months. Many birds and small animals are attracted to them and in exchange for their refuge they help keep the farmers' crops free from pests. When wildlife increases, some parts of town forests can be set aside for hunting during certain months of the year. In this way hunters may find sport without having to travel many miles, while their license fees will help support the home town.

Twenty-seven states have town forests. In many cases the city fathers receive advice and help from state colleges and universities where forestry and agriculture are subjects growing more popular each year.

Town forests not only give work to many local people, but they spread the idea of conservation and a need for training in forestry and agriculture. Through a growing co-operation between universities, states, and towns, young men graduating from schools of agriculture and forestry have the finest opportunity to find work. In one of our large midwestern universities, during 1938, all

the graduates in agriculture found jobs within three or four months. These young people became a part of our growing army of conservationists.

THE "PLANT TO PROSPER" CLUB

"Live at home! Grow your own food and feed. Join the 'Plant to Prosper' club." Headlines like these appear from time to time in one of our leading southern newspapers. People of the South have been reading about this club for three or four years, not only in one newspaper but in others that have taken up the idea.

In 1938, 42,000 farmers of Tennessee, Arkansas, Missouri, and Mississippi joined. During 1939 the plan spread like wildfire. More newspapers joined, more discouraged and homeless cotton farmers pricked up their ears—and joined. Farmers in five other states have been getting on their feet by learning, through the club, what to do with their farms.

The newspapers, together with the Chamber of Commerce of Memphis, each year run a contest for any members who want to take part. There are always several prizes, among them one for the best farming, the best farm home, the county hav-

ing the most Plant to Prosper farm members; and there is a prize for the newspaperman who works up the most interest in the club among the people of his county.

On prize day, in 1938, the largest award, \$500, was won by Mr. M——. He had scored on the most points, especially on his livestock, his crops, and his home.

"It's wonderful how that man did it," said one contestant to an outsider who had come to see the prizes given out. "Just think of it, two or three years ago Mr. M—— was a sharecropper, a farmer who had no land of his own and couldn't even rent a place! All he got to support his family was a small share of the crop from the cotton and corn acres of the landowner for whom he worked. You should have seen his house in those days—you could hardly call it a house—it was just a miserable cabin. He had a good wife who kept it neat, but you couldn't help seeing the cracks in the walls. And the furniture? The chairs looked as if they'd never hold up a well-fed person!

"Look at Mr. M——'s home today! He owns forty of those acres. There wasn't a decent farm building on them when he got hold of the place. He put up that six-room house and those barns

and outhouses himself. And while he was busy working outside on his cropland, his wife and children were canning fruits and vegetables inside.

"The government helped him a little because he planted cover crops on some of his acres instead of putting in cotton. But the county agent was the one who put that man on his feet. He explained that it is important to rotate crops and plow around contours if you want to keep your soil fertile and get the most out of it. The county agent showed Mr. M—— how the thing was done. And everything about what they did went down in a record book!

"Mr. M—— is a worker. He's got it in him! He cleared \$1,000 this year after paying off the debt on his land. But he's not the only one. There are hundreds of other fellows who've worked their way up from a straight corn-meal diet to having vegetables and meat on their tables. Many become owners after they've been in the club only a year or two. Their new crops—soy beans, other vegetables, and feed for stock—sell much better than the corn and cotton they used to raise, and they are way ahead in taking care of the soil.

"Each farmer keeps a record book just as Mr.

M—— does. That book is sacred to him. He takes it to all the club meetings and compares notes with the members. He knows from his book just how much he spends and takes in on every acre of his land.

"Storekeepers and city dealers and banks stand right behind this Plant to Prosper club because they know its members mean business and understand what they're talking about. They make the grade because they have learned what good farming can do for you. You won't find any of their children joining the Migs. These club farmers are building up their land and will give it to their children in good shape and without a mortgage on it."

R.T.R.

Alert stockmen in West Texas join the R.T.R. This is the Rest the Range program which the cattlemen planned among themselves. "To join our program," a cattleman will tell you, "you don't need to pay any fees. But you do need one thing that not every cattleman has—that is patience! Of course, we need one other thing, but no one except heaven can give it to us—rain, moisture for our range.

"The scheme is to rotate the range for our cattle. A range that is badly overgrazed gets a long vacation, several years, to build itself up. We cattlemen that belong to the R.T.R. aren't increasing our herds as we used to. We know that if we have too many cows there will not be enough feed for them on the range. So now we figure pretty carefully just how many cattle our acres can carry. That means land must never be grazed so closely that the topsoil begins to move with the wind or with the rain. And there must always be enough plant roots and new plants left to keep the cover growing.

"You'd be surprised how well the plan works. It's a whole lot better than ruining the range with too many cattle and then asking the government for money to help buy feed while the forage comes back."

XVIII. Conservation Goes Ahead

TOWNS AND COLLEGES ARE BECOMING ALERT

There are today in all parts of our country more than 36,000 conservation groups of one kind or another at work on our problems. They are the controls for our blights and pests, and like the gulls of Salt Lake, they find the spots where they are needed. Their aim is not only to do away with evils, but to restore natural and social balance. Because these conservation groups are still in the early pioneer stage they are not able to do so much as they will be able to ten years from now when more people understand the new fields that are opening.

We have seen how rapidly the idea of town forests has been spreading. Today there are eight hundred county and town forests in the United States, and each year more are acquired. Many kinds of bird and nature clubs for the protection of wildlife are found in our states.

Colleges and universities, too, are doing much to educate young people to protect the wealth of the country. Though they did not become alert

until the twentieth century, they play an important part today. It is hard to believe that our first college of forestry opened its doors less than fifty years ago. That was in 1898 at Cornell University; and the next one in 1900 at Yale, followed in 1903 by the Department of Forestry at the University of Michigan. But since then the conservation program has been growing fast! More than twenty other colleges have added four-year courses in forestry.

Besides the work carried on in universities there are departments of conservation and forestry in thirty-nine states. Most of these have recently opened. However, each state long ago had a grant of land from the government for a college of agriculture. It is from these agricultural colleges that county agents are sent to advise farmers about the use of their land.

THE CUT-OUT-AND-GET-OUT IDEA SHOULD BE SCRAPPED

Private lumbering companies are joining the ranks of conservationists. This is probably because they now find that, unless they make some plans for the future of their business, they will soon

have no business to plan for! Whatever their reason, the outcome looks hopeful.

In 1937 a National Forest Conservation Conference was held in Washington, D. C. Every lumber district in the United States sent a representative. Some of these men were interested in forests, some in manufacturing of wood products. The United States Forest Service and several other departments of the government at Washington sent representatives. It was the first large gathering of this kind and there was keen interest in all the meetings.

A program of "sustained forestry" was recommended. That is, the representatives agreed to the idea that forests should be "farmed," not destroyed; they should be used so that yearly products could be counted on. The leaders agreed that the time had come to scrap the cut-out-and-get-out plan, since it was really no plan at all, but just a hit-or-miss scheme left over from the old boom-and-bust days.

In a program of sustained yield, only "ripe" timber was to be cut, and the forest was to be cared for—new trees planted where necessary, the forest floor protected so that danger from fire was lessened. Animal life was to be encouraged, and

grazing carefully watched to see that young trees were not cropped off.

The men talked over the best way of keeping trees healthy so that pests would have less chance to do damage. They agreed that as soon as possible the goal should be to "use every part of the tree except the knotholes and the whispering among the branches."

In other words, these businessmen saw that the value of a forest "crop" should be judged not only by the number of logs that can be cut, but by the crop of products the forest will yield in the present and in years to come. Among these are resin, tar, turpentine, pitch, cork, nuts, seeds, rubber. It also was pointed out that poorer wood and branches can be made into pulp for paper, wall-board, plastics, rayon, cellophane, imitation leather, and various other things.

LANDOWNERS COMPLAIN ABOUT THE TAX SYSTEM

At this conference one representative asked, "Why do we lumbering men go on wasting large parts of our forest crops when we have no more free land and when about one-half the pulpwood used in our country is brought in from Canada

and Europe? Why cannot our lumbering waste be used for pulpwood?"

"It is, I think," another representative answered, "because the sustained yield plan is more expensive now than it needs to be. That's why many lumbermen cut over clean. It costs too much to save the slash, stumps, and branches and sell them to pulpwood concerns. We owners of forest land need help. If we are to protect town, county, or state watersheds, and if we are to be able to give employment to others in our forest lands, we should have fuller co-operation from the government, at least in the way of relief from high taxes.

"The present tax is not only a burden, but is unfair besides. Those of us who cut lumber from our woodlands with care on the sustained yield plan, have more to pay in taxes than the owners who cut clean, and clean out. They make a lot of money from their timber all at once; then when their land is not worth much because nothing is left on it, the government lowers their taxes! Would it not be more fair to those of us who carry on a sustained yield program to reward us for our co-operation, rather than reward the careless owner?

"Besides, in sustained yield forests we keep men employed right along. Our foresters know they will have regular jobs as long as their work is satisfactory. But the boom-and-bust fellow dismisses his men when he's cut his acres clean. There's no work for anyone after he's through unless you count the work the United States government and the state have to put in on his land to restore it!

"Of course, I appreciate what the government does to help us understand how to care for our forests and the money it provides to help us with fire protection. But we woodland owners who have well-cared-for property obey the laws; we protect the watersheds for the public. I feel it is only right that the government should help us with fire protection, especially when fires may be caused by careless people for whom we cannot possibly be responsible, and since we are paying heavy taxes because our land has trees on it.

"Now in Wisconsin they have the right idea. There they've made a law that farmers are excused from paying taxes on slopes that are wooded. Farmers in that state will want to keep their forests. They don't need to cut them over and

plow them to try to raise more crops to meet their bills. They can let their trees grow, can work out a sustained yield and wildlife program that will bring them a nice income. Their woodlands will at the same time protect the watershed of the town."

Today 400,000,000 acres of our 600,000,000 acres of forest land are in private hands. While most all of the land owned by Uncle Sam is cared for on a sustained yield basis, somewhat less than ten per cent (or about 40,000,000 acres) of the privately owned land is properly cared for and protected from fire.

Though most private owners now agree to the idea of sustained yield, they are very slow in carrying it out. Many people who want to protect the future of the country look at the matter in this way: "Since our millions of acres of forest land affect the lives of millions of people living on the watersheds where these forests grow, should not the government help to regulate their use just as it helps to regulate trade and banking and education and other public affairs? Should not the people be protected from private owners who still believe in the old get-rich-quick idea with no thought for tomorrow?"

DRINKING WATER AND DUMPING PLACE

Who owns the river? Who is responsible for the river—whether it brings floods, is filled with mud and waste, or not? No one. Everyone.

Because large rivers run through several states and may pass hundreds of cities, people downstream pay for or benefit by what people upstream do. The law of gravity has a lot to do with the river's direction, but only the law of man can keep a stream from becoming Ole Man River.

Many cities depend for their drinking water on the rivers flowing through them. If sewage is dumped into the waters, that sewage is delivered to towns below along with the drinking water! Mud washed from farms and cutover land gets into the stream. It, too, is delivered downstream along with the sewage and drinking water! This is true of many rivers. The Connecticut, the Sacramento, the Delaware are among them. Various branches of the Upper Mississippi River System have the same trouble.

Peoria, Illinois, on the Illinois River, was compelled by law to put in a system which would purify the waste water she dumped into the stream. Yet the factories above Peoria, in towns

without proper laws, dump their wastes into the same river ten times as fast as Peoria pours in her now purified sewage!

The oyster business of Delaware and Chesapeake bays is threatened because wastes from the Delaware and Potomac rivers pollute the waters with typhoid germs and oil. The fishing business at the mouth of the Connecticut River, where it enters the Long Island Sound, is in danger too.

Gradually businessmen realize that, whenever other large businesses are injured and our rivers exploited or our natural resources destroyed, they, too, are finally affected. Banks and stock companies which lend money to business fail if the real estate and railroad and other companies to whom they have lent money fail. Then all the people who have trusted their money to the banks and stock companies lose some or all of their savings.

States which "share" the same river are beginning to co-operate in working out a plan to protect health, business, and natural resources. State lines no longer act as fences to keep ideas in or out. More and more often people are working together in large districts that have things in common, such as the same kind of soil or weather. States in

watershed districts work together. Today we have the Mississippi Valley Committee, the New England Planning Commission, the Pacific Northwest Regional Planning Commission, the Northern Great Plains Committee, and many others. New York, New Jersey, and Pennsylvania co-operate in the use of the waters of the Delaware River. Southwestern states co-operate in the use of the Colorado River.

Many of these groups are beginning to feel that Uncle Sam should give them more help with the problem of river pollution, in addition to working with them on their flood control difficulties.

XIX. Uncle Sam's Laboratories

MANY KNOCK AT UNCLE SAM'S DOOR

When cities and states are without good leaders and without funds, Uncle Sam must come to their aid in time of trouble. The government at Washington has been the leader in the widening field of conservation. States greatly in need of help have been sending men to Washington to ask for advice and assistance. Some Dust Bowl states obtained it first in the way of money for food and clothes sent in through the Red Cross. But this helped only to keep the people alive. It did not restore their farms, nor did it bring rain to dry, dusty croplands.

Many small towns and some large ones were in tight places. They were in debt and saw no way of paying their bills. Even whole counties and states went bankrupt—their land and water troubles too much for them. Farmers on worn-out or dried-out land could not pay their taxes. One-time lumbermen were out of work; one-time timberland had become a waste. How could bankrupt farmers and lumbermen and owners of

ruined property pay taxes? They couldn't. Many of them did not make more than \$400 a year! Often the \$400 was not even a cash sum, payment being made partly in corn or fodder for cattle.

Drinking water, purifying waste city water, control of watersheds, cleaning out of dams and river channels, are public affairs. They are paid for by taxes from city, county, and state. Where was the money to come from to attend to these things and to care for the destitute farmers' families if owners could not meet their tax bills? Already the taxes of those who *could* pay were eaten up by the costs of schools and of roads to outlying run-down farms. Many mayors and governors had to face these questions.

THE CONSERVATION PROGRAM COMES OF AGE

When Theodore Roosevelt was President he gave the conservation program at Washington its first real start. But under Franklin D. Roosevelt it broadened out suddenly like a parachute opened in an emergency to save a flier leaping from a falling airplane. Uncle Sam became very active. He saw that it was time to look the whole country over to see exactly how serious its many ailments were.

In the first place, he wanted to know how much land had been eroded (washed or blown away) and how much was still being eroded. The Soil Erosion Service, which was later called the Soil Conservation Service, was established and a survey made of all our land. Among the many things found by the economists who made the survey was that 100,000,000 acres that had once been fertile farmland were worn out. There was no hope of restoring them, it was thought. What was more, 165,000,000 acres in the prairies would probably be ruined by overgrazing, plowing, or drought. Dust deserts were creeping farther and farther out on all sides. Dunes lay piled up thirty feet high. The government realized that this kind of thing could not be allowed to go on.

In 1935 the shelter belt plan was started in the Middle West. "These scorching winds from the west and south," the Forest Service said, "do great damage every summer. They must not be allowed to sweep across the prairies unchecked. We will set in broad strips of trees on farms—shelter belts that will break the wind. The trees will not only check the wind and the moving soil,

but their roots and shade will hold the winter's moisture."

Today the shelter belts stretch from the Dakotas through Texas. More than 11,000 miles have been planted. Since 1935 the Forest Service has been supplying the trees from its own nurseries at about five cents apiece, their cost price. WPA and CCC men have planted them. Farmers help. Besides taking care of the groves after they are started, farmers often set out small secondary groves.

The shelter belts are 100 feet wide and are composed of various kinds of trees that will grow best in each particular state. The strips are not in an unbroken line; they are planted on farmland on the side from which the strongest winds blow. By 1939 more than 126,000,000 trees had been planted on over 20,000 farms.

Reports show remarkable results from these shelter belts. Trees planted in 1935 are now thirty-five feet high. Many groves are already much like natural forests. The subsoil remains moist, and wildlife is increasing. During the summer the air is cooler, while during the winter farms protected by the trees burn much less coal than those open to cold blasting winds.

As to crops, one Kansas farmer not long ago said: "My wheat did well this year. It wasn't because we had more rain, for my neighbor's crop blew out—the hot wind and dust finished it. He had no shelter belt. I lost a little of my grain where there was a gap in the trees. You can be sure I'm going to see that that gap is filled in!"

A Texas farmer reported: "I raised strawberries this year—the first I've ever been able to grow."

An Oklahoma farmer sent word: "Some of the trees in my strip are wild plums and wild cherries. Today they are bearing fruit. My wife uses these to make jams; and, of course, the wild cherries attract birds which help to keep down garden pests."

Another farmer from Oklahoma reported that his forest strip had grown so dense that he could now cut out small trees to use for fence posts and fuel.

The Soil Conservation Service has set up more than 600 demonstration projects. It has also started 13 laboratories to show how good farming should be carried on. It has increased its tree nurseries to more than 40.

Uncle Sam saw that wildlife was threatened on all sides. In 1934 he appointed a committee to

find out what should be done to restore the damage. This committee, too, made a survey of the country. Its members reported that the ruin of animals and birds was most alarming. As a result of their findings, an act to help bring back wildlife was passed in 1937. Under this act the government aids any state with funds to protect its birds and animals, if that state will help with some of its own funds.

For some time it was realized that many of our birds suffered while migrating across the states during the spring and fall. In 1929 Uncle Sam had passed the Migratory Bird Conservation Act which gave him power to buy or rent lands in any state where migrating birds had nesting or feeding grounds. Refuges had been set aside where birds could be safe from hunters and would always find plenty of ponds, swampland, and food. By 1933 there were 99 such refuges; by 1937 there were 220 covering more than 2,000,000 acres.

But still further protection was needed since many birds spent their summers or winters outside the United States. Agreements were made with Canada and Mexico for the protection of both birds and animals. The first agreement with

Canada had been made in 1913, but in 1936 this act was changed to include Mexico as well.

Today, then, through government and international law, North American wildlife is being protected. But much remains to be done. Many more swamps, especially in the Northwest and the Middle West must be restored and still more refuges created. Wardens, too, are needed to guard the refuges. Funds to maintain them are few.

While President Franklin D. Roosevelt wanted to conserve our natural resources, he was, of course, anxious to do something more directly for the people. Soon after he became President he saw that 16,000,000 had no work, yet at the same time millions of acres were in need of immediate help. Putting two and two together, the government started hundreds of projects to give work to the unemployed.

Land on which owners could not pay taxes (tax-delinquent land) was bought by state and federal government. Everywhere gangs of men appeared, seedlings, bushes, spades in hand, to restore the wasted acres. Most of these were boys just out of high school or college who had enrolled in the CCC (Civilian Conservation Corps). Their work was to put in seedlings where forest

land had been burned over; set out bushes in dried-up marshes that the government was once more flooding for wildlife protection and to raise the water table; fight forest fires; and assist people during periods of floods. The CCC boys also helped farmers fill gullies that gaped in hillside acres. They aided in planting seedlings for many miles of shelter belts.

It was found that much of the land in the Dust Bowl could not be brought back to life while people were living on it. "Deserts cannot be reclaimed overnight," the soil doctors said. "The only thing to do is to move the farmers since they cannot afford to take their families to better homes."

Not merely one farmer here and there had to be moved, but whole towns! Shawneetown moved because it was threatened by too much water, but Dust Bowl families left because there was too little water! Sometimes the people of a whole village were taken to a better locality; sometimes they were scattered among near-by towns.

Not long ago there were 16,800 such families. The government bought their run-down land. By means of loans to the farmers it set up half of them in other places, at the same time showing

them how to use their new acres well. Arrangements were made for repayment of loans over a number of years.

The moving of so many people sounds expensive! It has been. But it costs much less to do this than it would to keep families year after year on land so poor that \$400 is the most a farmer can make in one year.

Many sharecroppers and tenants were living on land that could be restored. They were eager to buy property. Uncle Sam made loans to those who would co-operate by using their acres wisely. After two years the farmers began to pay back what they had borrowed. They were ahead of the time allowed them! The government had not only lent money to more than five thousand farmers, but it had also taught them how their land could be used to grow good crops. This worked out well and Uncle Sam was very happy about it. "All these farmers will repay their loans," he said. "But that is not all. The government will make a profit besides!"

GARDENS IN ALASKA

When you hear the word "Alaska" you probably think of glaciers, Eskimos, gold mining, fish-

ing, or summer tours along the Pacific coast. You are not likely to think of gardens and fresh vegetables. Few people did until Uncle Sam began looking for good land that might be used by the ruined Dust Bowl farmers.

In 1935, 245 farmers' families from Wisconsin, Minnesota, and Michigan packed their belongings, left their dried-out acres, and were taken to Alaska. There in the Matanuska Valley the weather is much like that where the farmers had come from, except that it does not grow so cold in winter. The air which blows across the warm Japan Current makes the valley one of the pleasantest spots in Alaska.

The new settlers had a hard time in the beginning because they had only tents to live in during the first summer and fall. Trees had to be cut down and homes built. There were few roads and few clearings, but plenty of mosquitoes!

However, rivers were full of fish and the soil was rich. After the first winter when the land was cleared, the country soon became green with strawberry plants, radishes, potatoes, peas, and lettuce.

Life in Matanuska Valley was pioneer life, rugged, hard. A few families left; they could not

stand the work. Others, each with forty acres of his own, are building a new colony that is now thriving. The expense of each family has been about \$3,000 but colonists are allowed thirty years in which to pay this back to the government.



Fresh vegetables from Alaska.

Already the newcomers are selling fresh vegetables to Alaskans in the near-by towns and along the coast. Never before have these people, mostly miners and fishermen, had fresh vegetables. They are much pleased to be able to buy "Matanuska Maid" products right at their own doorstep.

SEVEN-FIFTY PER ACRE, NO MORE, NO LESS

Other Dust Bowl farmers are going to the Northwest to our last frontiers in Washington, Oregon, and Idaho. Here are valleys which have rich soil but lack rainfall. Uncle Sam has been building dams on the Columbia River so that water may be brought into these fertile valleys. Grand Coulee Dam is the latest of these.

Uncle Sam stands guard at the doors of the newly opened acres in the valleys of the Northwest. Although at Grand Coulee there is no sign, "Speculators keep out!" yet it is made clear that no buying up of land in order to sell at a profit will be allowed.

Here are some of the rules of the Grand Coulee Dam project: No land is offered to farmers that is not good farmland. The price of an acre is about \$7.50, the same for the first man as for the last one. Any colonist who wishes to sell may do so for the same price which he paid—\$7.50 an acre, plus the price of improvements he has made. No kind of crop is to be raised for the market of which there is already too much in the country, such as cotton, wheat, corn, and tobacco. No single man may buy more than forty acres, no

family more than eighty. In other words, this farmland is being "controlled" so that each will receive his money's worth and each must be responsible for the care of his soil and the needs of the market. Newcomers are not encouraged to come in until the land is ready—irrigation plans made.

The Columbia River is the second largest river in the country. But because in the Columbia Basin it flows through a canyon 500 feet deep, there has never until now been any way to bring the water up to the rich but dry land above. The Grand Coulee Dam is almost a mile long and the waters that flow over it fall three times as far as the river at Niagara Falls. Behind the huge dam a lake 151 miles in length is forming. It will reach as far as Canada. Here is enough water to supply the needs of a valley that can almost hold the state of Connecticut: 1,200,000 acres of semi-desert will become a garden.

The eyes of the country will follow the Grand Coulee project. It is one of several that have been carefully planned in the Northwest, a part of the country that little by little will be able to take in many of the wandering midwestern and southern farmers who have lost their homes.

HUGE UNDERTAKINGS

The conservation program is full of important undertakings. We have seen how private groups such as the Audubon Society, the Plant to Prosper club, and the R.T.R. have gone ahead in some parts of the country. But many cities, counties, and states that have neither enough leaders nor enough funds must depend on the government at Washington for help.

The Washington undertakings which help people in every part of the country have been called "alphabet" experiments. Some of them, such as the CCC and the WPA, have been very successful in giving unemployed people useful work at a time when jobs were scarce.

Many of the projects have not only taught men and women useful trades, but have helped in the conservation of our natural resources. States frequently call on the CCC boys to help with reforestation on both public and private lands. These boys have planted more than 600,000,000 trees. Their help will be needed for many years to come, for it will take a long time to restore our 100,000,000 acres of ruined land. Every year still more acres are being ruined by overgrazing

or by poor farming methods. Until recently 850,000 acres were being laid waste yearly.

Some of the experiments tried since 1933 have been so successful that many people no longer think of them as experiments. Among these are the CCC and the colonies for homeseekers—Matanuska, Coulee Dam, and others. These and smaller undertakings are Uncle Sam's laboratories. All kinds of experiments, from the uses of different varieties of soil to the best ways to build inexpensive homes, are tried out in them. They are social laboratories and are much like health clinics. Here may come those needing advice about sick land or unsanitary rivers. Scientists, maps and charts in hand, are there to show the way and to answer questions.

Often the scientists are county agents, sent out by the state college. They study soil, kinds of crops, where crops will grow well, which are pest free, and what to do with surplus crops. They find out what grasses will grow best in dry places, which have the thickest roots, and which will grow the fastest. Some of these grasses will be planted in the Dust Bowl to keep millions of tons of soil from moving to other states or out to sea every year.

Today every one of our forty-eight states has a planning commission. Guesswork on farms has in the past brought poverty to many who did not understand such things as weather cycles, crop rotation, cover crops, and other soil conservation methods. Today few will venture to buy land and run it by guesswork. One-third of the state of Oklahoma has been laid waste through guesswork! But Oklahoma is now awake. It is learning how to save what is left and how to restore as far as possible the ruined acres. Some of our best soil doctors are working in laboratories in the University of Oklahoma and other states that have been having the most soil and water troubles.

RUINED ACRES RETURN TO UNCLE SAM

Uncle Sam now owns 50,000,000 acres of tax-delinquent land. And slowly he is buying back more! Most of this land he once gave away when it was healthy, covered with fine timber, and filled with wildlife. This was in the 1860's. He gave it for a trifling sum to people who called themselves "homesteaders." Many of them had "run through" farms in the East and were ready for further conquests! These men were not homemakers, for they made no plans for keeping the

land permanently healthy. What a rich dole they received! A great slice of our continent. But they ran through it in a generation.

Many of these ruined acres must now be restored with state and federal funds—the people's money. But perhaps this is not unfair, as some people may think, for in the past the public did nothing to make plans to protect their country. Indeed, it was our American citizens who helped make the laws that practically gave away these acres with no obligations to the owners to care for them.

It must always be remembered, that in a democracy the government is made by the people. During Lincoln's administration much land was given away to homesteaders. Uncle Sam did what the people at that time wished him to do. Little or no thought was given to the conservation of our natural resources during the Civil War. In the first place, there was not a widespread demand for a conservation program so long as there was land that could be used. Besides, there were no scientists at Washington whose special work it was to guard our natural resources.

But as the need arose for protecting our soil and wildlife, when there were no more free lands,

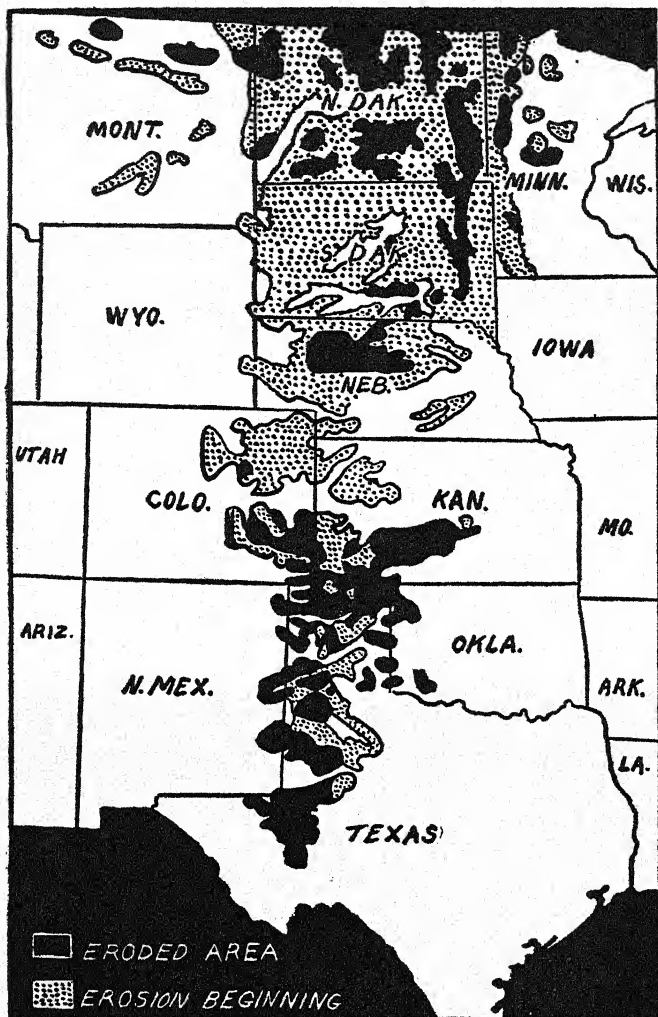
laws were made. Today our government at Washington, led by farseeing men of all our states, is working steadily on our problems.

Uncle Sam has already done much to revive our wasted lands. It will require many years and much labor, but the cost will be less than if we neglect them and allow more soil to be washed into the rivers and the lakes behind the dams downstream.

Besides, many of these acres form an important part of our great watershed areas. When forests once more grow on them, the lowered water table will rise. People will be able to move back again to abandoned farms which depend on underground water flow for their soil moisture.

In the future the states in the Dust Bowl will have something to say about the number of acres that may be used for crops such as corn, cotton, and tobacco which use up the soil rapidly and do not hold it with their roots. The millions of acres which have been ruined and have needed state and federal funds to help restore them must be safeguarded. Otherwise the day may come when still more acres are ruined and no more funds for restoration can be found.

Just as some people of New York State would



(Courtesy N. Y. "Times")

Old Dust Bowl area, according to government reports,
March, 1935.

like to change the laws which have been made to protect their watersheds, so Dust Bowl people who have planted many acres with grass to hold down their soil may feel that they should be allowed to plow under much of that grass, and plant crops as they used to. In 1937 rain soaked the Dust Bowl acres of Oklahoma and near-by states after years of dry weather. What happened? Farmers began to cast hopeful eyes at those acres of rich green grass. "Why," they said to each other, "should not crops be growing there instead of grass?"

Just how much control the state ought to have over what farmers plant is still a question to be worked out. In making plans for the use of land, the Weather Bureau today plays an important part—it forecasts chances of rain based on local conditions and on what happened in years past. Weather men know that there are weather cycles—long, rather dry periods lasting perhaps seventy years, long wet periods lasting just as many years. Within these large cycles there are shorter dry and wet cycles of perhaps eleven years. In the western grasslands success or failure in saving the soil and getting the most out of it depends very much

on studying these rain cycles and respecting them!

SMOKY HILL

In Smoky Hill, Colorado, more than 160,000 acres of flat and hilly farm and range land are under the soil doctor's care. At first only 40,000 of these acres were "cured," that is, these acres were brought to a point where they could safely be farmed if the owners followed the rules.

What did the owners have to do? If, before the soil doctor began his work, you had asked one of them, "What are you going to plant?" he would probably have answered something like this, "I'm going to try wheat again. It's a gamble though. My crops failed last year and the whole place dried out and turned to dust!"

But now when you ask him, he will probably push back his straw hat thoughtfully and say: "A good many things in a good many ways and at a good many times! The Soil Conservation Service men have taken my farm in hand. CCC boys have been helping. I was glad to have them do it, for I haven't been able to make a go of it for years."

A schedule for Smoky Hill has been carefully worked out to take care of these things: the small

amount of rain that will probably fall, the kind of soil on each part of the farm and range land, the varieties of crops that are to be planted and their arrangement.

If you watch one of the Smoky Hill farmers during the spring you will see what he meant by his answer. No longer do you see rolling acres of evenly plowed land stretching endlessly ahead of you; nor do you see terrible sand dunes blown into ridges and peaks during a particularly dry season. Instead, you see the farm plowed around the curve of the hills, you see terraces on some hills, and you see dams holding back rain water, making ponds where cattle may drink all summer.

You see strips of grass between strips of plowed land, and all the strips of grass do not look alike. "Some of the grass I've sowed," the farmer will tell you, "ripens early; the rest ripens later. In this way I'm always sure to have a crop growing every month. Grass and those trees I've put in stop wind-blown sand.

"In August, after I've cut off my last crop of oats and sorghum, I plant alfalfa. I never leave my land bare during the winter. The alfalfa is a cover crop. It doesn't get a chance to grow very tall before frost sets in, but it helps hold the land,

and alfalfa is a good plant to make your soil richer.

"You can see several kinds of grass and two or three selling crops—wheat, oats—growing in my fields; but next year you won't see the same things—at least not in the same places! Nowadays we change off most of our crops, especially in these dry parts of the country, every year. That's crop rotation you hear so much about out here. Where you see alfalfa this season you'll see wheat next season. Where you see oats now you may see clover next year. A lot depends on the rain forecast too. If we expect little rain we'll put in fewer selling crops and more cover crops.

"See all those fields of grass over there? We fenced those off so the cattle won't come in and graze there. They cropped off the grass right down to the ground a few years ago, and then the wind finished what the cattle had begun—it tore up and blew away the topsoil. We lost more than six inches of topsoil from this part of the country before we started in on our program of soil and water conservation.

"We don't lose anything, though, these days, not if we can help it! Fact is we come out with much more at the end of the season than we had

at the beginning—I don't mean crops alone, I mean gain for the soil in which those crops have been growing.

"We not only catch every speck of rain that falls and hold it back in ponds with dams or behind ridges we make with plows, but we get our fertilizer out of the air—that is, our nitrogen. Nitrogen is one of the things that gets used up fastest in the soil. Wheat and corn take it out. If you try to grow them several years in succession your crop gets poorer and poorer. That's why I put in alfalfa, clover, and beans nowadays. They take nitrogen from the air! It costs me nothing! What I don't use for fodder I plow under next spring. Then the ground is ready for oats or wheat without my putting any commercial nitrogen on it!

"See those hills over there beyond the fence? That's grazing land now. I never plan to grow anything but fodder and grass there. Those hills began to blow about badly when they were plowed under for wheat several years ago. They about ruined this farm. It looked just like a desert. But that's all over now. I keep a covering of grass on those hills all year round and raise some cattle there. This country could be a desert but it

doesn't have to be if we study it as a doctor studies a patient and then do the things we see are needed. That's what I learned from the soil experts.

"Those hills to the south were gullied once. I used to plow them up and down the grade along the fence. Of course, the rain water ran down the furrows and cut them deeper. In this part of the country our rains are sometimes short and heavy. They cut out a lot of soil if they get a chance! But they don't get a chance now, as you see. Those terraces and dams make that rain water walk!"

ANOTHER MISTAKE SET RIGHT BY UNCLE SAM

Our rivers today have many troubles. Though floods and murky waters are bad enough, a river with little or no water in it is a problem, indeed! Frequently, in parts of the country where summers are dry, rivers that suffer from serious floods in the spring are the very ones to go dry during the summer.

In North Dakota there is a river that wanders in from Canada. It makes a 357-mile loop and then wanders back into Canada. This river is the Souris. It is another case in the Northwest where, in the earlier 1900's, swamps were drained with

bad results for many people and thousands of waterfowl, and with good results for no one.

Today the river is a fine example of what can be done not only to restore country having naturally rich resources, but actually to enhance its wealth. There is not much use in trying to change country into something for which it is not suited.

The Souris does not look very important on the map. However, it is so important in many ways, not only to the state but to our Northwest, that several United States government departments have worked together on the valley.

Because of man's mistakes, the Souris River in the spring suffered from bad floods, yet in the summer the marshes were drained dry and the stream dwindled to a mere trickle. Once a great waterfowl refuge, the valley was abandoned by these birds and by the thousands of visitors and sportsmen who used to visit that part of the country. Though towns along the river purified their wastes before sending them into the stream, there was hardly enough water during the summer to flush the drainage away.

In 1936, after two years' work by the Biological Survey, the Prairie States Forestry Project,

the Bureau of Agricultural Engineering, the Resettlement Administration, and the CCC, the Souris River is once more in a healthy condition! A lot of planning, expense, and work—all because of the mistakes made by those who did not understand the country or its possibilities.

Today the Souris is a good-sized river all the year round. A great dam holds back the water at floodtime and collects it in a lake that will be thirty miles long when the valley fills up. During the summer, openings in the dam keep the river flowing at an even rate, and flood the seventy miles of marshes. Waterfowl, fish, and wildlife are returning.

CCC boys have done much of the work of restoration. They have helped count the birds and nests so that a record may be kept of their increase. They have made cuttings of poplars and willows and have planted them where they will hold water back; they have put in bushes; planted grasses that will supply food for wildlife; helped build shelters for game on small islands.

There will be no more trouble with this flourishing river, and visitors will once more go there from many places every year.

GRANDPA FENTON MOVES TO A NEW HOME

Grandpa Fenton stood with his foot resting on an old tree stump in his garden. He was watching what was going on in the field next door. His neighbor and two men were looking at charts and blueprints of the Tennessee Valley, and were pointing across to the hills beyond.

Grandpa Fenton knew what they were talking about—the homes on the other side of the valley, higher up. His neighbor and many other farm families had moved over there not long ago. They had been told that the low land would soon fill up with water when the river backed up behind the new Norris Dam. Grandpa Fenton, too, had been warned that he must move. His married daughter, Lydia, and her family had already left.

But he would not go if he could help it. Not he! Had not his folks lived on this side of the river for generations? What if the soil was no longer very good? This was his home. Besides, he did not really believe that the water backing up behind the dam would ever reach his farm. He was sure his place was too far up the slope for that.

But the young folks, his daughter and her fam-

ily, were after him every day. Perhaps he'd have to give in before long. The work in the old home was too much for his wife, Mattie. She wasn't as spry as she used to be.

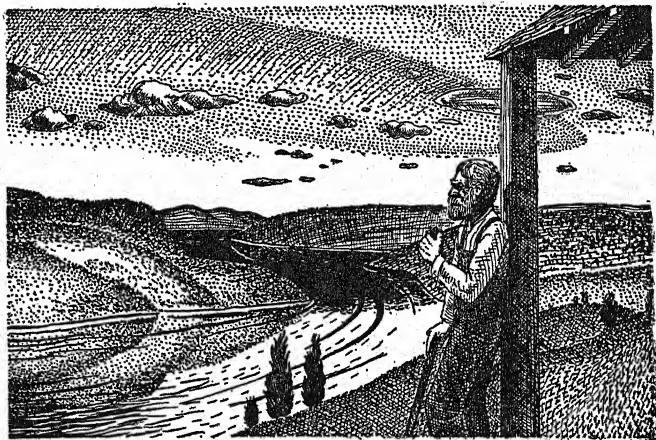
The young people liked their new home. They said it was much more comfortable than the house they had left. It was those newfangled electric things that made the difference, most likely. His daughter said her whole cottage was lighted by electricity. If Grandpa and Grandma Fenton would only come, there was a room waiting for them.

Lydia never had to clean an oil lamp these days, nor go to the well for water for her washing. Water was pumped into her house by an electric motor. She had an electric iron and washer. Her husband, Abner, said he knew a man who shaved with an electric razor! He, Grandpa Fenton, would never use an electric razor; he'd keep his beard! Yes, and he'd keep his old clothes; he'd keep his old home and his cow— all of 'em right where they were— if he could!

As his neighbor drove off with the men, he felt in his pocket for his pipe and looked around his side of the valley. Here and there he could make out a cabin in a clearing—empty. Grandpa Fen-

ton was now the only one left in his home on the whole slope. The rest of the families had moved to the other side, farther up the hill.

The old man pulled out his corncob pipe and carefully filled it with tobacco. As he lit it he



Grandpa Fenton was the only one left.

looked up the beautiful green valley. He could see some young men planting trees on bare spots. The government had bought a strip a quarter of a mile wide all around the hills where the edge of Norris Lake would be.

Those young men must be CCC boys. He'd heard they had helped to plant over 50,000,000

trees so far in this part of the country. The trees would keep the soil from washing down and filling up the lake. No one ever used to pay attention to soil moving down the hills—that was why the farmland was so poor, he'd been told. But there was to be no more soil running off into the brooks and rivers. Government men and the farmers who were working with them would see to that.

Well, it would take quite a few trees to fill up that strip around a lake that would have a shore line of more than 700 miles. He'd heard they were raising some new kinds of trees—a cross between the hickory and the pecan—"hican" they called it. He hoped they'd have better luck with their nut trees than he'd had. All his chestnuts had died—blight. Now the government men were trying to raise chestnuts once more—but they were not American chestnuts, they were from China or some other country beyond the seas.

The government had told Grandpa Fenton that where his home now stood there'd be hundreds of fish swimming around before long. Up farther there'd be a boathouse, maybe, for he'd heard that motorboats were going to take people from one side of the lake to the other. They'd take

parties out fishing too, or just for a spin to see the huge reservoir.

Perhaps it was all really true! He could see trucks driving across Norris Dam. He had never dreamed that such a dam could be built. Strange things were happening in the valley.

He had talked with CCC boys. He'd told them that if they let so much water gather behind the dams they'd have a sight of trouble with mosquitoes. Didn't the government know that in some of these parts mosquitoes had things their own way? They were dangerous—they carried malaria.

But the CCC boys said the government knew about that; they had made plans to control the pests. That was it, they'd made plans for everything, the government and the colleges and the young people of the valley together, it seemed to Grandpa Fenton. They even knew just how much land was to be used for cover crops, how much for forest, and how much for food crops; and just where every new house would be. Airplanes had been flying over the valley for the past year. One of them had taken photographs of the whole countryside. They pieced the pictures together and made big charts. He'd seen some of them. By look-

ing at the charts you could tell just where every hill, every farm, every brook was.

Grandpa Fenton puffed at his pipe. He wondered how much longer he could stay in his old home before he'd find the lake at his doorstep some morning. He had heard that more than 10,000 families had to be moved because their homes were on property where the reservoirs were to be. If they kept on building dams in the 650-mile valley and making immense lakes behind them, he guessed more families than that would be leaving.

Twelve big dams would make some difference in the valley when water backed up for miles behind them. Some of these, he knew, would create water power, electricity—"white coal," people called it. There had never been any of that in his part of the country. Electricity was much cleaner and cheaper than coal, and could do a lot more for you on a farm.

He knew of a man who had an electric hay dryer—a good thing in a country where you had so much rain that you couldn't keep hay in a barn without ruining it. He even knew of a man who had a slight current running through a fence to keep his bull from getting out. The bull wouldn't go near the fence once he'd run into it!

When Norris Lake began to fill up, Grandpa and Grandma Fenton moved to their new home with Lydia and her family. They were the last to arrive. Their valley, the Tennessee Valley, was in the hands of doctors—soil and water scientists. The 6,000,000 people, farmers and their families for the most part, who lived here could no longer make a living on their acres. This valley had been one of the richest in the country. But hilly land; heavy rainfall; much plowing up and down the slopes; no knowledge of gully control; planting of cotton or tobacco or corn year after year without change; leaving the plowed ground always open to rains, never holding it down with a cover of grass or clover—ruin! That had been the story of the valley.

Today many of the farms throughout this part of the country are changed—prosperous. Gullies have been filled—sometimes old automobiles or stoves were dropped in first. Branches, stumps of trees, have been thrown in to stop the rush of water. Locust trees, bushes, lespedeza, and kudzu vines have been planted to hold the earth together. Slowly the topsoil is being fastened down in gullies and on hillsides, and no longer moves.

You do not see corn growing on hillsides. In-

stead, there are trees or grazing land for cows. On gentle slopes where crops may be planted the soil is plowed around the curve. There are terraces on many fields. These prevent the soil from moving down during heavy rainstorms. Nowhere has the land been plowed up and down the slope leaving channels to carry off the rain quickly. "Water," say the soil doctors, "must walk, not run. Then we shall have it where it can work for us."

Man is making the water of the Tennessee River do many things for him. This is possible because in its short journey through the valley the great stream comes down from high mountains. Its waters meet dams and at each one they must do some work before they can go on and at last reach the Ohio and Mississippi rivers. One-fifth of the water that has been flooding farms and towns below Paducah in the Mississippi Valley has come from the turbulent Tennessee River.

When the ten or more dams are completed in this great valley, much less water will enter the Mississippi at floodtimes. Some will rest for weeks or perhaps months in the large lakes behind dams; some will run out during the summer when there is less rainfall, keeping the river at an even flow

and creating electricity by putting powerful turbines to work.

This great undertaking is being carried on by the TVA (Tennessee Valley Authority) which is a part of Uncle Sam's program to help people who are struggling with poor soil and who have had little or no chance to learn how to help themselves.

A new day is beginning in many parts of the South. Though it seems hard to tear old people away from land that is being reclaimed or that will become part of a lake behind a dam, yet they are receiving needed help. Most farmers in the valley are glad to be able to learn how to make a good living once more, but no farmer needs to accept help or make any changes if he does not wish to. However, those living down in the valleys that are to be flooded for reservoirs have been asked to move. They have been given other land, as good or better than their former property.

Young people in this part of the country now have opportunities to develop their land and learn the art of homemaking, having electricity to help them. Some work in small canneries where they can preserve their farm products. Some work in potteries that have been started there to carry on

the craftwork these people are skilled in. Many older people attend schools and colleges along with their children, for among the mountains of the South, far from railroads and cities, there have never before been the same opportunities to learn new skills or improve old ones.

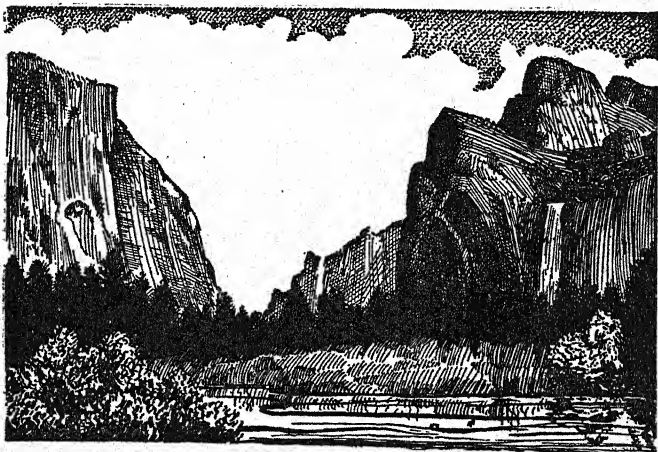
UNCLE SAM'S FORESTS

Today there are in our country about 160 national forests. Most of these are in the West. In 1891, when Uncle Sam saw that he must do something to protect our wildlife, forests, and watersheds, he found that there was little good public land left in the East. But since beginnings were made, he has taken over 174,000,000 acres in forty of our states and in Alaska and Puerto Rico.

There is still much land now in private hands that should belong to Uncle Sam. In 1939 the people of Michigan asked the government to buy 800,000 acres of virgin forest that are the "last stand" in that part of the North. Instead of letting these acres fall into the hands of cut-out-and-get-out lumbermen, they wished Uncle Sam to take charge of the lumbering. They know that he understands how to do this on a sustained yield basis,

letting private companies make bids for the lumber.

In many cases when a state wishes to buy lands, Uncle Sam will co-operate in the purchase—he



Our great national resources, like these forests, must be protected.

lends funds which are to be repaid from the sale of forest products. No state may take over forests until it can care for them in the way that is most helpful to the public.

Each state forest is to be a public laboratory in

which the best forestry methods are carried on. Here businessmen, landowners, and others may learn how to make the most of everything in their woodlands and forests.

Uncle Sam allows the people to use the national forests in as many ways as possible. Wherever timber is cut and sold it is done under the care of the Forest Service; 12,350,000 cattle, sheep, and goats graze in some of the national forests. Ranchers pay fees and follow rules—the grazing does not harm the woodlands.

The government also sells water power to create electricity for towns and industry. In addition, there is an immense tourist trade in our western forest regions. This brings an income to many.

But no one can measure in dollars and cents the pleasure Americans may have in their woodlands. For the most part Uncle Sam allows each state to make its own laws about fishing and hunting in national forests within its borders. Here are clear, sparkling streams that will be forever protected for the people's use. Here are wild animals that may be enjoyed in their native haunts. Hunters may at certain times go into some of our mountain playlands for game.

Uncle Sam does not make large sums of money

in our national forests, but what he makes he shares with the state in which the forest lies—one-fourth goes to the state, the rest goes into his own pocket to be used for the whole country.

The most skilled men in our states are in charge of national forest laboratories, of which there are twelve so far. They spend their time discovering such things as new uses for wood, especially the waste parts that go with the lumbering business; strength of various kinds of wood; how to preserve wood from decay; what materials may be used for wood substitutes—since we may want to stop cutting forests for a time until our watersheds are once more well covered; how to manage forests in order to obtain as much as possible from them and yet keep them in healthy condition; how to care for ruined, tax-delinquent land.

UNCLE SAM HELPS PRIVATE BUSINESS

Private owners of farms, woodland, and businesses in cities have often failed because of lack of planning ahead and because of waste of resources—land, timber, wildlife, minerals.* Wherever possible the United States government is helping

* We cannot go into the story of the waste in coal, oil, and other minerals in this book. That is a long story in itself.

private owners, especially when natural resources are being used and many people are employed. Uncle Sam is anxious to encourage people to work out things for themselves.

Our government has proved in its forest laboratories that the sustained yield program will work. In the South, where many forests are now being used for pulpwood, the Forest Service is working with private companies in planning a sustained yield program. It is hoped that the pulpwood industry will soon be secure for the future. There will be no more wasted land in the South, watersheds will be protected, and wildlife will flourish.

The RFC (Reconstruction Finance Corporation) at Washington is a huge government loan company. It lends funds to many kinds of private projects which can repay the government when their business begins to make money.

The newspaper pulpwood business of Texas is one of the companies being helped by RFC funds. About half of our pulpwood for paper is bought from Canada and even Europe. But southern companies are now planning to go into the pulpwood business on a large scale.

"We have millions of acres of pine down here," the owners of new mills in the South will tell you.

"We can supply our newspapers with as much good pulp as they need, and can do it at less cost than Canadians. We can save much money on freight charges too. Our southern pines will grow to a good size in fifteen years while it takes Canadian spruce trees sixty years to reach the right size. We intend to keep our millions of acres of trees just where they are. We will use the sustained yield plan and will never cut over clean. Our trees will work for us for generations to come."

The RFC has lent a company at Lufkin, Texas, about \$3,000,000 to build its huge plants. The government can afford to do this only because the sustained yield plan is to be followed. Lufkin is in no danger of becoming one of the hundreds of ghost towns which dot the country. This thriving Texas town will begin paying back its debt to Uncle Sam in a year after its plants are started.

XX. Conclusion

Whatever the land and water troubles of our country, east, west, north, south, they are *our* troubles. We brought them on ourselves, we can find out what to do about them. The land we have laid waste and that has fallen into Uncle Sam's hands is still our land. He has taken it back at our request or with our consent.

There are times when we can be more successful in using our natural resources if we have the help of the government. But both the government and we ourselves agree that the more we take individual responsibility while working with experts the more happiness and real success we will have. The Plant to Prosper Club is pointing the way in nine states of the South.

We see now that priceless wealth has been slipping out from under us—blown in dust over our heads, washed out by water beneath our feet. Our bills for levees along our great rivers have been growing—but engineers know today that they dare not make some levees any higher. We must look upstream for the reasons why our floods are so vast. There, where the "little waters," the

small streams, flow down from among the mountains and hills, lies much of the trouble. Many slopes are bare, the soil washing into rivers and out to sea.

CCC boys and WPA men, under the direction of the Soil Conservation Service, together with the Forest Service, have been doing pioneer work in soil and stream control. Spade and seedling in hand, they have been a quiet but useful army—anchoring the soil, saving our country.

So great are the problems in our vast land that we need still other armies: one, an army of farmers and foresters to restore nature's millions of tiny dams—blades of grass, trees, a forest floor carpet of leaves and roots; another, an army of engineers to build dams to hold back the water in wayside streams and large rivers so that it will work for us before it reaches the sea. Too long have our streams been rushing past us taking with them our wealth, our topsoil.

For centuries man has harnessed the waterfall and made it turn a wheel to grind corn or saw wood; for years we have harnessed the river and have brought electric power across miles to our cities, there to run motors, electric cleaners, washing machines, floor polishers, and all sorts of de-

vices. How strange that we had not thought seriously of harnessing every drop of rain on our crop and forest land! It would not have been hard to hold the rich soil and perhaps make it even richer by careful use.

Washington and Jefferson were both observant farmers. They understood the value of soil and saw that it was washing off their sloping land. They had their fields plowed around the curve of the hill. But our feeling that we had endless forests, endless land, and endless wildlife led us astray. We did not stop to see what was happening.

Anchor our soil we must, for drifting dust means drifting, destitute people. Migs, the homeless, wandering farmers anxious to find work but having no land that is good enough to use, must be anchored once more. Farmers living on run-down acres must be helped. This can be done as soon as we learn to cherish our natural wealth while we still have some.

Today conservationists are watching the beaver at work along our small streams with the same respect the Indian had long ago for this industrious friend of the forest. One small beaver can do more to conserve our wildlife than many well-meaning

men who do not understand the rules of the forest.

When we have built our dams and restored nature's checks on raindrops, the bills for levees and endless dredging of rivers and streams will no longer keep Uncle Sam awake nights. And when we have put water back into the underground desert we have created in large parts of the Middle West, Uncle Sam will have even more rest at night. Low water tables mean low incomes not only for the people living in the dry grasslands above them, but also for bankers in the East who own mortgages on western property.

Unless the water table is raised, millions of acres of western land will remain desert or the home of nothing more than the lowly tumbleweed, for it may be that even prairie grass with its thick, deep roots will not return unless there is enough underground water.

Our education in schools has taught us to read from books. We understand signposts and signals of city, town, or village. TO LET, FOR SALE, HELP WANTED, are signs clearly understood. Warning signals such as NO TRESPASSING; KEEP OUT; WATCH YOUR STEP; KEEP TO THE RIGHT; DANGER, CURVE AHEAD—all these we well know the meaning of.

There is never any trouble in deciding that it is wise to obey them.

What about the signs outside the city—in the woods and fields? Many of us in both town and country cannot even see them. An Indian, a Scout, or a forester can read the language of everything in the woods about him. Moss on the ground, he knows, means constant dampness and acid soil in which grass and certain flowers will not grow well; a little pile of tiny bones beneath a tree means an owl has been feasting on mice in its hole above.

The wise man knows that great stretches of dry grasslands mean little rainfall; heavily wooded hills mean much rainfall. These seem as plain to him as the nose on his face. Yet many Americans have paid no attention to them and to what happens to vast grasslands when they are plowed under. So many farmers have not noticed what happens to plowed-up hillside acres when there is a rainstorm that it is hard to believe they know much about nature's laws. Nature has conspicuous warning signals; for what are dust storms, rivers full of mud, floods growing worse yearly, gullies in croplands, too many field mice, too many weeds, if not warnings? All are nature's "stop" signals. Dust and muddy waters tell us plainly that

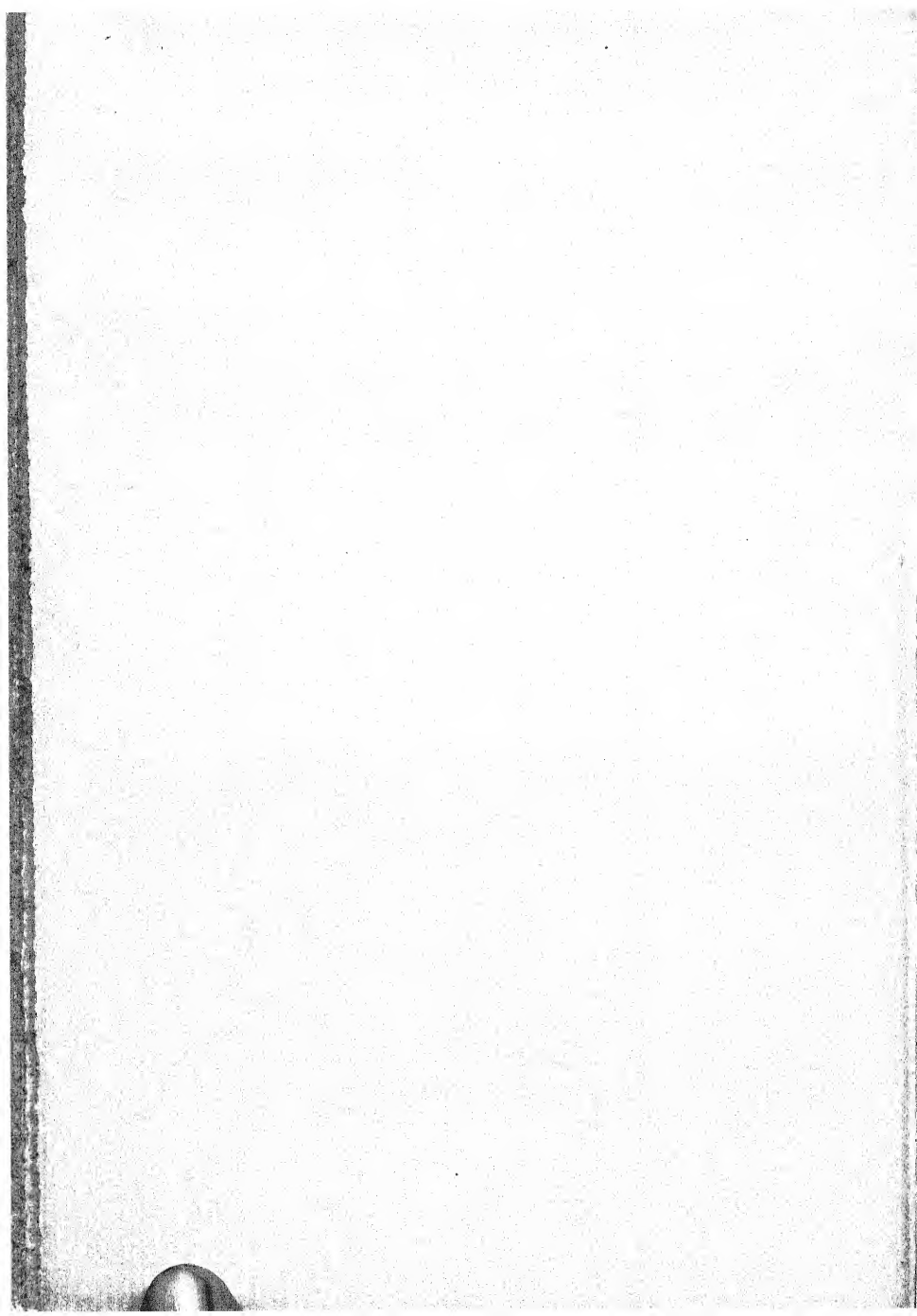
the topsoil, our wealth, is blowing or washing away. Too many mice mean that someone has been killing owls and hawks. Too many weeds mean that soil is run-down—it needs care.

In some ways our education has been strange, indeed. The same farmer who knows enough to stop when he sees a red light at a crossing will not stop and fill the gullies eating into his topsoil!

But the last depression, during which we have found there were no more free lands to turn to, has awakened us. We need thoughtful people more than anything else, conservationists, sociologists, who will study our resource problems with the energy of our old pioneers. Some may tell us that the cream of our country is gone—its best topsoil, its best forests. Even if that is so, we may still remain a strong nation. After all, people do not grow sturdy on food that falls into their laps too easily! We respect the pioneers not for what they got but for what they overcame. They were successful in reaching all parts of our country and setting farming and industry going. But they left it to us to make the country a "going concern," to find a balance between the lusty but squandering get-rich-quick idea and the plan of looking ahead to provide opportunity for our children.

Our new pioneers are people with ideas and energy—not one here and one there, but whole armies of young and old. Boys and girls who plant trees or shrubs to hold soil and provide nesting places for game, who build birdhouses, who shoot birds only with cameras, who are careful to put out every spark of their campfires, are just as surely conservationists as are members of the United States Forest Service or the Soil Conservation Service or any of the private or government groups working with them.

When the man in the street and the children in our public schools begin to understand the needs of our country and take pride in building rather than squandering, each working with the others, then our conservation program will bring enduring wealth—both in natural resources and in happiness.



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INDEX

- Alaska, 241ff., 269
- Arkansas, 9, 218
- Audubon, John James, 187, 204
- Audubon Society, 172, 175, 205-208, 246
- Australia, 144-148

- Beavers, 190-197, 277
- Birds, control pests, 154, 155
 - exterminated, 185-187
 - in marshland, 48, 166-175
- Bison, 4, 188
- Boy Scouts of America, 209
- Business affected, 10, 13, 24, 108-110, 165, 231, 233
 - (see also Forests, Land)

- California, fires, 117ff.
 - fish protected, 184
 - Migs, 87
 - oil, 178
 - wildlife, 158, 186, 187
- Canada, 101, 198, 238, 245
 - beavers, 196
 - fires, 119
 - pulpwood, 273
- China, 100, 151, 203
- CCC, 118, 152, 236, 247, 253, 259, 262, 264, 276
 - work explained, 239, 240, 246
- Colorado, 194, 253
- Columbia River, 184, 244, 245

- Connecticut River, 180, 230
- Conservation program, 185, 201ff., 223 ff., 246ff.
- Controls, 131-135, 163, 200
- Coon Creek Valley, 76-78
- Co-operation, 152, 213, 218, 228-232, 238, 269
 - between states, 182, 231, 232,
 - federal and state, 239, 258, 270
 - (see also Nature, balance of)
- Cotton, 23, 244, 256
- County agent, 220, 224, 247

- Dams, 63, 244, 259, 265, 278
- Democracy, 204, 249
 - (see also Co-operation)
- Dust Bowl, 28, 66, 139, 233, 240ff., 250-252
 - (see also Land, Prairies)

- Epidemics, 134, 143-155, 200
- Erosion, along Mississippi, 98
 - amount in United States, 101
 - by air, 10, 235
 - by air and water, 9-15, 101, 235, 275, 279
 - by water, 10, 49, 53, 96, 177, 266
 - defined, 96, 97, 235
 - (see also Overgrazing Soil Conservation Service, Topsoil)

- Farmers, aided by government,
 90, 240
 along Mississippi, 64-69
 colonial, 36, 37
 fight pests, 152ff.
 improve methods, 77, 218ff.
 loans to, 240, 241
 moved by government, 66,
 240-245
 tenants, 28, 53, 241
- Fish, hatcheries, 55
 injured by oil, 177-182, 231
 laws to protect, 184, 271
- Floods, 69-71
 checked by beavers, 192-196
 in pioneer days, 41
 on Mississippi, 57-69
 (see also Erosion)
- Florida, 165-175, 205, 207
- Flyways, 135, 159-162, 179
- Forests, area in U. S., 110
 cut-over, 16, 22, 44ff., 112
 fires, 49, 116-125, 165ff.
 government protection, 110,
 111, 115-117, 227ff., 270
 grazing in, 271
 importance, 106ff., 198
 laboratories, 270-272
 leased, 53
 length of time on earth, 106
 privately owned, 110, 229
 products, 226
 state, 270
 taxes on, 227
 town, 214-216
 (see also Lumbering, Shelter
 belts)
- Forest Service, 225, 235, 271-
 273
- Fossils, 127, 128, 134
- 4-H Clubs, 210-214
- General Wildlife Federation,
 212
- Georgia, 97
- Ghost towns, 44-46, 75
- Glacier, 101-105
- Government aid, to farmers, 68,
 90, 152, 220, 236, 239ff.
 lumbering companies, 21, 227,
 273
 private business, 272
 states, 168, 172, 194, 233
 (see also CCC, Fish, Floods,
 Wildlife)
- Grand Coulee Dam, 244, 245
- Grey Owl, 198-200
- Gullies, 97, 100, 177, 240, 266
- Hunters, along flyways, 159ff.
 in pioneer days, 37ff.
 sportsmen vs. pothunters, 156ff.
 threaten wildlife, 185ff., 200,
 206
- Idaho, 119-121, 244
- Illinois, 44, 57, 64-67, 194, 230
- Indians, 5, 26, 31ff., 138, 163,
 188, 198ff., 208, 279
- Jefferson, Thomas, 4, 24, 25,
 277
- Kansas, 140, 152, 179, 237
- Kentucky, 24, 46, 59, 60
- Land, acres wasted yearly, 246,
 247

- leasing of, 18, 28, 53
- mortgaged, 29, 89, 113
- no longer free, 28, 84, 249
- not endless, 113, 138, 277
- ruined, 12, 112, 166, 233, 246, 248
- speculation in, 26, 47, 165ff.
- tax-delinquent, 113, 239, 248
- Land-grant colleges, 224, 247
- Levees, 65-69, 275
- Lincoln, Abraham, 26, 249
- Lumbering, cut-out-and-get-out, 20, 45, 224, 269
- on leased land, 17, 53, 54
- sustained yield, 225-229, 269, 273, 274
- (see also Forests)
- Massachusetts, 103, 214, 215
- Mexico, 238
- Michigan, 16-21, 43, 242, 269
- Migratory Bird Act, 238
- Migs, 87-93, 221, 277
- Mississippi River, 41, 57-69, 230, 267
- every man's business, 57ff., 72
- floods, 57-69
- moves its bed, 65, 97, 98
- shortened, 97, 98
- Nantucket fish, 183, 184
- National forests, 269ff.
- National Forest Conservation Conference, 225ff.
- Nature, balance of, 106, 129-140, 189
- explained, 131
- works slowly, 101, 126, 127
- New England, 31, 103-105, 183, 214, 232
- New York City Water Supply, 114, 232
- New York State, 31, 114-116, 214, 232, 250
- rainfall, 60
- Norris Dam, 260, 264
- North Dakota, 27, 74, 82, 236, 257
- Ohio River, 44, 67, 105, 267
- Oil pollution, 177-182, 231
- Oklahoma, 26, 237, 248, 252
- Oregon, 20, 25, 119, 244
- Overgrazing, 246
- by rabbits, 144
- by sheep, 54
- checked, 221, 222
- in Yellowstone Park, 149, 150
- Oysters, 180, 231
- Pests (see Epidemics)
- Planning, 234ff.
- commissions, 248
- Plant to Prosper Club, 218-221, 275
- Pollution of waters, mud, 46, 49, 53, 124
- oil, 177-182, 231
- wastes, 49, 51, 182, 230-232
- Pothunters, 156ff., 165ff., 185-189
- Prairies, 12-16, 26-28, 91, 140, 152-155, 161, 240, 247, 250, 279
- (see also Dust Bowl and Land)
- Pulpwood, 18, 226, 273, 274

- RFC, 273, 274
 R. T. R., 221, 222
 Roosevelt, Franklin D., 234, 239
 Roosevelt, Theodore, 206, 207,
 234
 Sacramento River, 69, 76, 230
 Sanctuaries and refuges, 199,
 206, 238, 239
 Shawneetown, 66-68, 240
 Shelter belts, 235-237, 240
 Soil Conservation Service, 152,
 235, 253, 276
 South Dakota, 12, 27, 74, 82, 236
 Speculators, 26, 47, 166, 169, 170
 Subsoil, 79, 95-97, 103
 Sustained yield, 225-229, 269,
 273, 274
 Swamps drained, 47, 165ff.,
 257ff.
 Taxes, delinquent, 113, 239, 248
 on forest land, 227
 Tennessee, 9, 60, 177, 218, 260ff.
 TVA, 260ff.
 Texas, 25, 152, 188, 237, 274
 Tobacco, 23, 244, 266
 Topsoil, care of, 85, 86, 90,
 253ff.
 described, 95, 102, 104
 experiment with, 86
 importance, 86, 97
 in China, 100, 203
 in forests, 19, 48
 length of time to build, 101
 loss, 10, 84ff., 101
 on hillsides, 10, 22, 266
 Trees, ripe, 111, 225
 Washington, George, 4, 277
 Washington State, 21, 66, 119,
 244
 Water, drinking, 114, 230ff.
 (see also Pollution of waters)
 Watershed, 73ff., 114-116, 227-
 232, 252
 defined, 73, 78
 Water table, 79, 82, 161, 278
 Weather cycles, 252, 253
 Westward movement, 3-6, 24-
 28
 Wildlife, destroyed in fires, 118,
 124, 171, 172
 destroyed by draining swamps,
 47, 165ff., 258
 destroyed by industry, 176ff.
 exterminated, 185-189
 on farms, 156ff., 209-214
 protection for, 158, 201ff.
 (see also Fish, Nature, balance
 of)
 Wisconsin, 43, 165, 171, 228,
 242
 Coon Creek Valley, 76-78
 marshes drained, 47ff.
 sawmills, 44
 turkeys, 194
 World War, 27, 45
 WPA, 152, 236, 246, 276
 Wyoming, 27, 149

